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ABSTRACT

This final report is based on a 3-year study pertaining to financial support for vocational education. Chapter 1 summarizes findings and recommendations of the last year of study, including specific suggestions for administering federal and state grants-on-aid for vocational education, and Chapter 2 incorporates information about the cost of vocational education obtained from field studies conducted by the research team. Procedures to project the annual cost of replacing obsolete instructional equipment are discussed in Chapter 3, while evaluation of programs through cost effectiveness analysis and suggestions for conducting follow-up studies of graduates are described in Chapter 4. In Chapter 5, the rationale for federal aid for vocational education and alternative apportionment formulas are examined, and Chapter 6 examines the problem of apportioning categorical aid funds for vocational education among local schools. Some recommendations pertaining to the administration of federal and state funds are: (1) Specific guidelines should be established for prorating indirect costs among instructional programs, (2) State education agencies should establish standards for acquiring, maintaining, and replacing instructional equipment, and (3) National goals for vocational education should be established with sufficient precision so that the cost of attaining them can be estimated. (SB)

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Erick L. Lindman
Principal Investigator
Graduate School of Education
University of California
Los Angeles

September 1972

U.S. DEPARTMENT OF
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FOREWORD

This is the final report based on a three-year study pertaining to financial support for vocational education, sponsored by a grant to UCLA from the U.S. Office of Education. The first report, emphasizing long-term cost projections, was issued in 1970 as *Special Study No. 4 of the National Education Finance Project.*

Chapter I summarizes findings and recommendations of the last year of study. It includes specific suggestions for administering Federal and state grants-in-aid for vocational education. Although the principal investigator is responsible for the major recommendations, including formulas used in cost analyses, most of the work of the study was done by graduate students, each of whom wrote a chapter for this report.

Chapter II incorporates information about the cost of vocational education obtained from field studies conducted by the entire team. Daniel G. Aldrich, III had major responsibility for planning and coordinating these studies and for analyzing the data. He wrote Chapter II, which also includes his own findings and recommendations.

The cost of equipping vocational shops and laboratories was investigated by E. Charles Parker, who is the author of Chapter III. He developed the procedures used to project annual cost for replacing obsolete instructional equipment.

The problem of monitoring vocational education programs was investigated by Leonard Shymoniak. His efforts to relate benefits and costs of vocational education, and his suggestions for conducting follow-up studies of graduates of vocational programs, are described in Chapter IV.

In Chapter V, the rationale for Federal aid for vocational education and alternative apportionment formulas are examined. These analyses were made by Paul Gilbert, who reports his findings in Chapter V.

The problem of apportioning categorical aid funds for vocational education among local schools was examined by Marvin Heinsohn. The results of his research are presented in Chapter VI.

In addition to the staff of graduate students who did the major work of the study, appreciation is expressed to Chief State School Officers and State Directors of Vocational Education who supplied essential information. Much of the field work was carried on in seven states, with valuable help from the following representatives from these states: California (Roland M. Boldt); Florida (C.M. Lawrence); Michigan (William Weisgerber); Ohio (C.O. Tower); Texas (Luther Thompson, Jr.); Utah (Sherman G. Eyre); and Washington (Arthur M. Lewis).

Erick L. Lindman
Principal Investigator

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CHAPTER I

OVERVIEW AND SUMMARY OF MAJOR RECOMMENDATIONS

Prior to the twentieth century, the American tax-supported public school system placed little emphasis on vocational education. The three R's were stressed in the common schools because their mastery was necessary to read the Bible and to discharge one's obligations as a citizen. Mastery of these skills was also an essential prerequisite for admission into a high school to prepare for college. The elementary school emphasized the fundamental skills of reading, writing, and arithmetic, and the high school concentrated on preparation for entrance into college.

Efforts to introduce vocational education into the established public school system inevitably encountered resistance. The vocational education teachers usually did not have college degrees and their "blue collars" set them apart. Moreover, they often required expensive shops and equipment, creating budgetary problems for the school.

These difficulties could have been easily overcome were it not for parental resistance to enrolling their children in vocational education programs. To parents, enrollment of a student in vocational education meant foreclosing his opportunity to attend a college or university.

The dilemma of the American comprehensive high school is quite clear. If a student devotes most of his efforts in high school preparing for a job which does not require a college degree, he may forfeit the opportunity to enter a four-year college -- but he has a good chance of getting a job upon graduation from high school. On the other hand, a student who shuns vocational courses in high school and concentrates on the college preparatory program may find this road closed to him for lack of academic aptitude or money -- in which case he is thrown upon the labor market without adequate training.

One way the public school system has sought to resolve this dilemma is to make it possible to postpone career choices until after graduation from high school. With this approach, vocational education is centered in post-secondary schools, mainly community colleges. The choice between vocational education and college transfer work comes two years later, when a student presumably is in a better position to make a choice. Although this plan is satisfactory for many young people, it is entirely unsatisfactory for students who find the college preparatory program irrelevant. Often these students drop out of high school unless they are given the opportunity to learn to use tools that will help them find employment.

This poses a policy choice concerning the grade placement of vocational education. Should these courses be offered in the high school, or should the high school offer only general and college preparatory education, leaving vocational courses for post-secondary schools? From the standpoint of career decisions, the student is benefited by keeping his options open as long as possible. However, from the standpoint of skill development, early selection of career goals is desirable.

To this dilemma must be added the problem of anticipating future job opportunities. Changing technology and economic conditions tend to make specialized occupational skills obsolete. The acceleration of this trend in recent years has been cited as an argument for excluding "specialized" vocational education from the public school curriculum. If job skills, it is argued, are specific to an industry at a specific time, then each industry should train (and retrain) its own workers as needed.

Although this argument is valid for a highly specialized skill required by a few people in a single industry, it does not apply to vocational skills needed by large numbers of workers in many different industries. Vocational educators in high schools have sought to emphasize the latter fact, preparing students in a "cluster" of job skills suitable for a "family" of occupations.

The close relationship between vocational education and placement poses another problem for the vocational educator: Should the public school maintain a placement service for its graduates? The provision of such service by the school would tend to make the school more alert to the requirements of the labor market and, consequently, the tendency to train people for non-existent jobs would be minimized.

At present, publicly supported employment services are under the Department of Labor, and the appropriate role for the public schools in the placement process is related to the location of this responsibility within the Federal structure.

PUBLIC SCHOOL POLICIES PERTAINING TO VOCATIONAL EDUCATION

Acceptance of vocational education as a responsibility of public schools developed slowly after the turn of the century. The Commission on the Reorganization of Secondary Education, appointed by the National Education Association, issued an influential statement on the goals and objectives of education in 1918, entitled "Cardinal Principles of Secondary Education." Among the seven main objectives of secondary education identified by the Commission was vocational education. Specifically, the Commission stated:

> 4. Vocation. Vocational education should equip the individual to secure a livelihood for himself and those dependent on him, to serve society well through his vocation, to maintain the right relationships

> toward his fellow workers and society, and, as far as possible, to find his own best development.
>
> This ideal demands that the pupil explore his own capacities and aptitudes, and make a survey of the world's work, to the end that he may select his vocation wisely. Hence, an effective program of vocational guidance in the secondary school is essential.
>
> Vocational education should aim to develop an appreciation of the significance of the vocation to the community, and a clear conception of right relations between the members of the chosen vocation, between different vocational groups, between employer and employee, and between producer and consumer. These aspects of vocational education, heretofore neglected, demand emphatic attention.
>
> The extent to which the secondary school should offer training for a specific vocation depends upon the vocation, the facilities that the school can acquire, and the opportunity that the pupil may have to obtain such training later. To achieve satisfactory results, those proficient in that vocation should be employed as instructors and the actual conditions of the vocation should be utilized either within the high school or in cooperation with the home, farm, shop, or office. Much of the pupil's time will be required to produce such efficiency.

The clear statement concerning the high school's responsibility for vocational education was issued by a Commission representing American secondary school leaders in 1918. Thirty-five years later, in 1953, the National Association of Secondary School Principals issued a widely accepted statement entitled, "The Imperative Needs of Youth." Ten imperative needs were identified, the first of which was saleable skills:

> All youth need to develop saleable skills and those understandings and attitudes that make the worker an intelligent and productive participant in economic life. To this end, most youth need supervised work experience as well as education in the skills and knowledge of their occupations.

Despite these and subsequent statements declaring vocational education to be a responsibility of public high schools, implementation was slow in coming. One of the most significant influences promoting vocational education was enactment of the Smith-Hughes Act in 1918. This Act, and state plans developed pursuant to it, defined vocational education narrowly and limited the use of Federal funds to courses designed to develop skills for specific occupations.

Partly to encourage the introduction of new courses designed to develop occupational skills, and partly to avoid dilution of available Federal funds, courses included in the general education program were not financed from Federal vocational education funds, even though the courses developed essential occupational skills. For example, the first course in typing was not regarded as a vocational course, because many general education students took a beginning course in typing for personal use. However, advanced typing courses were defined as vocational because virtually all students who enrolled in such courses expected to use typing in their employment.

Related instruction, essential for a vocation, was excluded from the definition of vocational education if it was normally included in the general high school program. Thus, courses in English composition, essential for a secretary or printer, were not financed from Federal vocational education funds because English composition courses were normally included in the general high school program.

The Vocational Education Acts of 1963 and 1968 authorized substantial increases in Federal funds and broadened the purpose of various programs. The thinking behind these changes is readily apparent in the definition of vocational education appearing in a report of the Advisory Council to the Subcommittee on Education of the Committee on Labor and Public Welfare of the United States Senate, issued in March 1968. In this report, the Council suggested that the objectives of vocational education should include development of the individual, as well as meeting the needs of the labor market. Vocational education, said the Council, is therefore related to those aspects of educational experience which help a person to (1) discover his talents, (2) relate his talents to the world of work, (3) choose an occupation, (4) refine his talents, and (5) use his talents successfully in employment.

The problem of determining whether a course should be designated as vocational education would be of little interest, except that this definition determines how Federal categorical aid funds for vocational education are to be expended. The statutory basis for this definition is spelled out in the Vocational Education Acts of 1963 and 1968, which authorize:

> Federal grants to states to assist them to maintain, extend, and improve existing programs of vocational education, to develop new programs of vocational education, and to provide part-time employment for youths who need the earnings from such employment to continue their vocational training on a full-time basis, so that persons of all ages in all communities of the State – those in high school, those who have completed or discontinued their formal education and are preparing to enter the labor market, those who have already entered the labor market but need to upgrade their skills or learn new ones, those with special educational handicaps, and those in post-secondary schools –

> will have ready access to vocational training or retraining which is of high quality, which is realistic in the light of actual or anticipated opportunities for gainful employment, and which is suited to their needs, interests, and ability to benefit from such training.

The foregoing legal provisions do little to define vocational education per se. Instead, they indicate a Congressional intent to make vocational education available to a variety of potential students.

SUMMARY OF MAJOR RECOMMENDATIONS

The Federal government's concern for vocational education stems in part from its concern for full employment. The latter responsibility cannot be accepted without assurance that vocational education is available to help the labor force acquire the skills needed for a changing technology. To provide this assurance, the Federal government has chosen to stimulate, with categorical grants-in-aid, the development of vocational education programs in public high schools, adult schools, and post-high-school institutions.

This raises two questions that are discussed in Chapter V of this report: (1) how much should the Federal government contribute annually to the states for vocational education, and (2) how should these funds be apportioned among the states?

The amount of the Federal contribution should be directly related to national goals for vocational education. Broadly stated goals, such as, "Every young person should have a saleable skill when he completes his formal schooling," are too general and do not indicate the amounts of resources needed to achieve the goal.

It would also be unwise to develop national quotas for numbers of persons to prepare for designated occupations in each state. National goals for vocational education need to be specific enough to permit valid cost estimates without destroying the freedom of choice which characterizes the American economy in vocational courses. A suggested national goal at this time is that vocational education should be available to 50 percent of all public school students.

However, it is not enough to specify the percentage of all students for whom vocational education should be available. The national goal should also indicate what fraction of the average vocational student's total school time needs to be devoted to such courses. Because of uncertainty concerning the appropriate grade placement of vocational instruction (in junior high schools, senior high schools, or junior colleges) and incomplete national statistics concerning post-secondary schools (junior colleges and vocational schools), it is necessary to base national goals on the well-established 12-grade public school system. On this basis, it is suggested that the students enrolled in vocational courses should spend an average of one full year, or one-twelfth of their total schooling, in such courses. This may be accomplished by spending half-time in vocational courses for two years, or quarter-time for four years. With this national goal, approximately one-half of all public school students would spend the equivalent of one full year in vocational courses.

To implement this goal, it is suggested that the Federal government contribute the additional or excess cost incurred by public schools for offering this amount of vocational education instead of the less expensive general or college preparatory instruction. To estimate the amount required annually for this purpose, it is necessary to know the percentage by which the average cost per student in vocational courses exceeds the corresponding cost per student in general education courses in public schools. A number of studies have been conducted to determine this percentage, with most findings varying between 60 and 90 percent. For the purpose of estimating the additional or excess cost incurred by public schools to meet the suggested national goal, it is assumed that the average cost per student in vocational courses exceeds the corresponding cost for general education by 75 percent.

The proposed formula for estimating the national total additional or excess cost of vocational education is:

$$\text{Additional Cost} = \frac{P_1\ P_2\ P_3}{1 + P_1\ P_2\ P_3} \times \begin{array}{l}\text{Total Current}\\ \text{Expenditures for}\\ \text{Public Elementary \&}\\ \text{Secondary Schools}\end{array}$$

where

P_1 = the percent of all public school students who receive some instruction in vocational courses.

P_2 = the percent of school time that vocational students spend in vocational courses based upon 12 years of schooling.

P_3 = the percent by which the average cost per student in vocational courses exceeds the corresponding cost for general education in public schools.

Based upon the suggested national goals, the estimated cost is:

$$\text{Additional Cost} = \frac{1/2 \times 1/12 \times 3/4}{1 + 1/2 \times 1/12 \times 3/4} \times \begin{array}{l}\text{Total Current Expenses}\\ \text{for Public Elementary \&}\\ \text{Secondary Schools}\end{array}$$

$$\text{Additional Cost} = .03 \times \$36 = \$1.08\text{B}$$

This amount excludes requirements for adult education as well as funds needed to erect buildings, or to equip new shops and laboratories. With pertinent additions for these purposes, the Federal appropriation for vocational education can and should be directly related to national goals for vocational education.

The apportionment of the Federal funds among states raises several problems that are discussed in Chapter V. The inherent conflict between an apportionment formula which emphasizes need and one that rewards accomplishment is pointed out. Moreover, program data reported by states, such as enrollment in vocational programs and expenditures for vocational education, are not sufficiently standardized to be used for the apportionment of Federal funds among states.

For these reasons, the present apportionment formula, based primarily upon population (and adjusted moderately for differences in per capita income), is satisfactory.

New problems are encountered, however, after the Federal funds are received by state agencies. The Federal funds, along with supplementary state funds for vocational education, must be distributed among local school systems. This process raises two difficult questions: (1) How should the total cost of vocational education in a local school system be determined, and (2) after the cost is determined, what part of it should be contributed from Federal and state funds appropriated for vocational education?

To determine the approved cost of vocational education in local school systems, a "three-component formula" is recommended. Under this formula, the total current cost of vocational education is composed of three components:

1. An amount for the salaries of vocational teachers, based upon the amounts due them under an approved salary schedule plus an additional percentage for salaries of substitutes (sick leave) and other fringe benefits. For this purpose, a state salary schedule, or an approved local salary schedule, may be used. To determine the amount in this allotment, it is necessary only to identify the full-time equivalent number of vocational teachers and supervisors, and the salaries they receive under the approved schedule. The amount calculated in this manner would be increased by a state standard percentage (say 10%) to cover costs of fringe benefits.

2. A standard support component equal to the state average current expenditure (excluding teachers' salaries, pupil transportation, student services, and community services) per teacher. Under this allotment, all high schools or post-secondary schools in the state would receive the same amount per vocational teacher, and the amount would be based upon the state average expenditure per teacher in all classrooms in the state.

3. A special support allotment based upon unusual costs incurred in maintaining vocational shops and laboratories. The amount allowed for this purpose would be determined separately for each program and would include amounts needed to replace obsolete instructional equipment.

Using this three-component formula, the total cost of the vocational education program in each local school district should be determined. From these amounts should be deducted general state aid, or foundation program amounts, earned by the vocational education programs. The difference between the total approved cost of the vocational education program and the amount of general state aid earned by it, is the residual cost of the program. This is the portion of the cost of vocational education not provided for in the general state school support system, and it should be the basis for categorical aid payments to local school systems for vocational education.

After the residual cost of approved vocational education programs has been determined for each local school system, the state has several reimbursement options. The selection of the appropriate option will depend upon the state's overall approach to public school finance.

One option is to reimburse all school districts for the full amount of the residual cost from Federal and/or state funds appropriated specifically for vocational education. This approach to financing vocational education would be especially appropriate for states in which there is no local tax for public schools. Although there is only one such state at present, other states are moving in this direction. If the Serrano decision is upheld by the U.S. Supreme Court, reliance upon local property taxation for public school support would probably decrease.

Under the Serrano decision, local property taxation for public schools must be eliminated or equalized. If it is eliminated, then 100 percent reimbursement of the residual cost of vocational education is recommended. If local property taxation is to be retained and equalized, then reimbursement of a part of the residual cost from Federal and state sources is recommended, using a variable reimbursement percentage which is inversely related to the assessed valuation per student of school districts.

A general variable percentage reimbursement formula suitable for this purpose is:

$$P = \frac{R - EQ}{R + (1-E)\,Q}$$

where:

P = percent of the residual cost to be reimbursed from state and/or Federal vocational education funds.

Q = the index of taxable wealth of a school district obtained by dividing the assessed valuation per student of the school district by the corresponding state average assessed valuation per student. Note that Q is a variable with different values for each district.

E = a parameter with an assigned value between zero and plus one which indicates the fraction of the local funds to be equalized by the percentage formula.

R = a parameter which determines the overall proportion of costs to be paid from state and/or Federal vocational education funds.

The development of a suitable percentage reimbursement formula requires the assignment of specific values to the parameters R and E. These assignments need to be made with answers to two questions clearly in mind: (1) What percentage of the residual cost of vocational education should be reimbursed to a school district of average wealth per pupil (Q equals 1)? (2) How wealthy should a school district be before it is expected to pay all of the residual cost of vocational education programs from local sources only? (Or, for what value of Q should P be equal to zero?)

The following formulas have values for R and E, so that a school district of average wealth (Q equals 1) would have a reimbursement percentage equal to 50 percent of its residual cost, and a school district in which the assessed valuation per pupil is three times the state average (Q equals 3) would have a reimbursement percent equal to zero.

Two formulas which meet these conditions are suggested. In the first (Formula 1), R equals 3/2 and E equals 1/2. In Formula II, R equals 3 and E equals 1, and a 75 percent proration factor has been inserted.

$$\text{I} \qquad P = \frac{3/2 - 1/2\,Q}{3/2 + 1/2\,Q} = \frac{3 - Q}{3 + Q}$$

$$\text{II} \qquad P = \frac{3 - Q}{3} \times 3/4 = \frac{3 - Q}{4}$$

Note that in both formulas, if Q equals 1, P equals 50 percent; and, if Q equals 3, P equals zero.

Computation of reimbursement percentages is shown in the following table for hypothetical school districts with different wealth indexes. School district A is a poor district, in which the assessed valuation of taxable property per student is equal to 1/4 of the state average (Q equals 1/4). School district B is also quite poor (Q equals 1/2). In school district C, the assessed valuation of taxable property per student is exactly equal to the state average (Q equals 1). School districts D, E, and F are above average in taxable wealth per student, with Q values ranging from 3/2 to 3. The reimbursement percentages are shown in columns 3 and 4 for Formulas I and II, respectively.

School District	Wealth Index Q	Reimbursement Formula I	Percentage Formula II
1	2	3	4
A	1/4	85%	68%
B	1/2	71%	62%
C	1	50%	50%
D	3/2	33%	37%
E	2	20%	25%
F	3	0	0

Note that Formula I is more generous to the low-wealth districts A and B, whereas Formula II is more generous to school districts with Q values between 1 and 3. On this basis, Formula I is preferable.

Both of these formulas would require approximately the same amount of state money. If the amount of state and Federal funds available for reimbursing the residual cost of vocational education were substantially more or less, the formulas would need to be adjusted by assigning different values to the parameters R and E.

These are the major recommendations pertaining to the administration of Federal and state funds for vocational education. Other recommendations made by members of the research team are given at the conclusion of their respective chapters. For the convenience of the reader, those recommendations are summarized here.

Chapter II: Recommendations

1. Adaptation of the program accounting structure used in this study should be considered by state and local educational administrators.

2. Specific guidelines should be established for prorating indirect costs among instructional programs.

3. State vocational administrators should thoroughly examine vocational instructional equipment replacement and maintenance policies within their states.

4. State vocational administrators should conduct cost-effectiveness studies that compare high school and community college vocational programs.

5. State and Federal legislators should strongly consider increasing vocational current categorical support to include the current cost of industrial arts service.

6. State vocational administrators should consider a three-component system for estimating and controlling vocational program costs.

Chapter III: Recommendations

1. State education agencies should establish standards for acquiring, maintaining, and replacing instructional equipment needed for vocational education programs.

2. State education agencies should develop a plan to reimburse local districts for the acquisition and replacement costs of major instructional equipment.

Chapter IV: Recommendations

1. More effective use of follow-up studies should be made by local educational administrators to improve evaluation of current vocational education program accomplishments.

2. Regular evaluation through cost-effectiveness analysis should be made in order to provide the educational administrator with more information for measuring the strengths and weaknesses of the various instructional programs and their supporting activities.

3. Cooperative agreements for facilities' sharing should be considered between and among (a) departments (programs) in each school and (b) districts in the area, in order to maintain or increase program offerings in school districts.

Chapter V: Recommendations

1. National goals for vocational education should be established with sufficient precision so that the cost of attaining them can be estimated.

2. The Federal Government should appropriate for the support of vocational education each year an amount sufficient to pay the additional costs incurred by public schools in providing the required vocational courses.

3. Federal funds for vocational education should be apportioned among states in accordance with the formula enacted in the Vocational Education Act of 1968.

Chapter VI: Recommendation

1. State educational administrators should consider a five-step procedure for allocating Federal and earmarked state vocational funds among school districts.

CHAPTER II

AN ANALYSIS OF VOCATIONAL PROGRAM COSTS

Daniel G. Aldrich III

THE PROBLEM

The past decade has seen increased recognition of vocational education's importance to the welfare of the United States. Schoolmen have accepted a "saleable skill" as imperative for all youth. Economists have stressed education as an investment rather than a consumer expenditure. Other scholars have stated that our society must improve the social and economic expectations of a major portion of our citizenry. Finally, many political leaders have become convinced of the critical need for vocational education. Nevertheless, despite this widespread acknowledgment, American education is still predominantly occupied with the 20 percent of this country's students who complete a college education.

One obstacle to initiation and expansion of vocational education in the public schools has been the contention that it is more costly than other instructional programs. Aware of this problem, Congress, in the 1968 Vocational Education Amendments, established the difference in cost between vocational programs and other instructional programs as one of the criteria that states must use to distribute Federal vocational funds. In order to comply with the criterion, states and local agencies were obliged to identify the cost difference, which in turn required the determination of accurate vocational program total costs and unit costs.

Need. The problem of determining educational costs has challenged researchers for almost 70 years. Cubberly was among the first to investigate the variables involved in establishing a unit base of educational expense.[1] His historic work in educational finance precipitated further studies that have sought to refine the practices of analyzing expenditures so that more accurate educational cost estimates could be made.

Before 1960 only a few studies, such as one conducted by Harvey Henry Davis in 1928, addressed themselves to the costs of various instructional programs.[2] Since 1960 several additional studies have been written: Anderson[3], Baldwin[4], Cage,[5] Parry,[6] Robertson,[7] Swanson[8] and Wattenbarger[9] have examined those costs. This increased attention to the costs of instructional programs is attributable to various causes of which three are most important. First, there now exists greatly accelerated competition among all levels of government for a larger share of the tax dollar. Second, public demands upon educational systems for accountability have been mounting continuously. Third, the expansion of the community college movement with its dual concern for both college transfer programs and vocational programs has, in light of the above, required closer examination of these programs.

Analysis of the procedures used in the studies cited above reveals four critical areas of concern:

1. Budget chart of accounts
2. Proration of indirect costs
3. Base unit of measurement
4. Development of a cost estimation formula

First, the budget account structure utilized by each of the above studies included as part of the cost of instruction the accounts for student services, for auxiliary services (transportation, food, health), and for community services. Inclusion of these service costs raised two concerns:

a. The practice prohibited the public from clearly assessing the cost and value of these additional non-instructional services provided by their educational institutions.

b. Reported costs of the instructional programs were inflated.

Second, most of the writers of the studies allocated indirect costs by utilizing one of the following measures: student enrollment, student contact hour of instruction, or student credit hour of instruction. Exceptions to this were the studies by Baldwin and Parry in which, additionally, a square footage factor was utilized to prorate the indirect costs of plant operation and maintenance. Since most researchers employed only one proration procedure, concern was expressed as to whether this could adequately distribute all indirect costs proportionately among various instructional programs. Guidelines suggested by Badger[10] and by the USOE[11] indicated the need for utilizing more than one proration method.

Third, the investigators Cage, Parry, and Swanson[12] utilized the clock hour or contact hour as their base unit of cost comparison. However, Anderson, Robertson, and Wattenbarger[13] chose the credit hour as their base unit of measure. Use of this latter base unit, with its problems as identified by Stevens and Elliott,[14] caused concern as to the precision of the identified program costs.

Fourth, only one study (by Baldwin)[15] could be found that attempted to develop a cost estimation formula utilizing various components. Testing of that model found that it produced course cost differences of up to 21 percent from those produced by the detailed cost analysis procedure.

From the above findings the subsequent conclusions were made:

a. Procedures used for determining the cost of instructional programs were inadequate.

b. Additional research was required for the development of an instructional program cost estimation formula.

The following paragraphs examine the need for this study from the standpoint of practice by state and local educational administrators.[16] During the first phase of this project, a survey was conducted in 15 state departments of education to ascertain whether procedures had been developed to identify the total cost of vocational programs.* Researchers identified two problem areas. First, the majority of state education departments had not developed program accounting procedures for vocational education. For example, in 12 of the 15 states, vocational program costs were reported to varying extents solely for the direct expenditures of instructional salaries and supplies. Other direct expenditures, e.g., textbooks and replacement of instructional equipment, were not generally identified. In addition, only three states had procedures to determine indirect program costs. New York prorated indirect costs on the basis of pupil hours of instruction. The other two multiplied a state-determined percentage (California, 24%; Utah, 20%) times the identified direct cost to ascertain the appropriate indirect cost. On the basis of the foregoing, the researchers concluded that procedures within most of the sampled states could not ascertain the total cost of a vocational program.

The second problem area was lack of an objective procedure for estimating and controlling the cost of approved vocational education courses and programs. In many instances legislatures were not approving increased appropriations for vocational programs until their costs were more accurately determined.

Both research and field practice made apparent the need to assist state and local educational administrators in determining vocational program costs.

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*The following states participated in the survey:

California
Colorado
Florida
Illinois
Michigan
Minnesota
New Hampshire
New York
Ohio
Oregon
Tennessee
Texas
Utah
Washington
Wisconsin

Ten of the above states were chosen as a result of their returning a portion of their Title V ESEA money to USOE to finance the survey. Five other states were added so as to provide a better cross-section of how states were financing vocational education throughout the nation.

Purpose

The intent of this study is to determine vocational program costs at both the high school and the community college levels primarily for the purpose of administering categorical fund support. In order to do this, three objectives had to be achieved. First, current costs of vocational programs had to be identified, which required the development of a program accounting procedure that included (a) a chart of accounts, and (b) procedures for prorating indirect costs.

Second, after the costs of programs were determined, appropriate program unit costs could be established to serve as a basis for meaningful cost comparisons. Development of such a basis was the second objective. Finally, a formula was created and tested, utilizing unit costs determined from the above to estimate and control, for purposes of allocation, the cost of vocational programs – the third objective.

Delimitations

This study was limited to the fiscal year from July 1, 1969, to June 30, 1970. The period from September 1, 1969, to August 31, 1970, was utilized for the academic year. This study considered the fiscal year and academic year as coinciding. The specific time period was chosen because it was the most recent in which the required data were totally accessible.

The study was confined to the establishment of cost per annual student contact hour of instruction for vocational programs, industrial art programs, and other instructional programs. Omitted from this study was any consideration of costs for Manpower Development and Training Act programs. Also excluded was any consideration of the expenditures for capital outlay and debt service. The rationale for this exclusion is given in the Procedures section of this chapter.

Definition of Terms

In order to minimize possible uncertainties of terms used in this study, technical terminology is defined below.

Agricultural Programs. A group of courses involving knowledge and skills in agricultural subjects such as plant science, soil science, animal science, farm management, agricultural mechanization, and agricultural leadership.

Comprehensive High School. A secondary school with a number of departments (e.g., academic, industrial, business) offering a diversified program to meet the needs of pupils with varying interests and capabilities.

Course. An organized body of subject matter in which instruction is offered within a given period of time.

Direct Costs. *Expenditures that can be attributed directly to specific* instructional programs.

Distributive Programs. Courses grouped primarily in marketing or merchandising of goods or services.

Full-Time-Equivalent Teacher. An academic staff member who devotes his entire time to teaching (or two teachers, each devoting half-time).

Home Economics Programs. Courses involving knowledge and skills in the following subjects: child development; family relationships; food and nutrition; clothing and textiles; family economics and home management; housing, home furnishings and equipment; and family health.

Indirect Costs. Those current costs that represent overhead, administrative and other expenditures that must be prorated among several programs.

Industrial Arts Programs. Instructional shopwork of a non-vocational type that provides general educational experiences centered around the industrial and technical aspects of life today, and offers orientation in the areas of appreciation, production, consumption, and recreation through actual experiences with materials and goods. It also provides exploratory experiences that are helpful in the choice of a vocation.

Instructional Program. A grouping of common courses of academic, professional, or technical training, given with a degree of specialization suitable for the level at which it is offered and for the institution proposing it.

Junior (Community) College. An institution of higher education that offers the first two years of college instruction, normally grants an associate degree, but does not grant a bachelor's degree. Offerings include transfer and/or terminal programs (with an immediate employment objective) at the post-secondary instructional level and also may include adult education programs. It is an independently organized institution. The term does not refer to the lower division of a four-year institution, even if that lower division is located on a campus separate from the campus of the parent institution.

Office Programs. Courses that require knowledge of public and/or private enterprises and are related to the facilitating function of the office. They include such offerings as recording and retrieval of data, supervision and coordination of office activities, communication, and reporting of information.

Official Class Enrollment. The Average Daily Membership that is officially reported to the state for each class during the year.

Other Instructional Programs. The courses provided by the examined institutions other than vocational, industrial art, and MDTA.

Proration. The allocation of parts of a single expenditure to two or more different accounts in proportion to the benefit that the expenditure provides for the purpose (or program area) for which the accounts were established.

Student Contact Hour of Instruction. One student scheduled to receive instruction for 50 to 60 minutes.

Technical Programs. Courses that require understanding of the laws of science and principles of technology, as applied to modern design, production, distribution, and service.

Trade and Industrial Programs. Courses that are planned to develop basic manipulative skills, safety judgment, technical knowledge, and related occupational information for the purpose of fitting persons for initial employment in industrial occupations and upgrading or retraining workers employed in industry.

Vocational Education. Vocational or technical training or retraining given in schools or classes (including field or laboratory work incidental thereto) under public supervision and control, or under contract with a state board or local educational agency, and conducted as part of a program designed to prepare individuals for gainful employment as semi-skilled or skilled workers or technicians in recognized occupations (including any program designed to prepare individuals for gainful employment). Vocational or technical training or retraining may be assisted by Federal funds under the Vocational Education Act of 1946 and supplementary vocational education acts, but excluding any program to prepare individuals for employment in occupations which the Commissioner determines, and specifies in regulations, to be generally considered professional or as requiring a baccalaureate or higher degree.

THE PROCEDURES

Budget Chart of Accounts. Development of a program accounting structure for determining the total cost of an instructional program necessitated a number of decisions regarding what expenses to include and how to classify them. As discussed earlier in ascertaining an instructional program's cost, past studies had incorporated all institutional expenditures within that cost. In light of the public's recent rejections at the polls of requests for additional educational funds and its demands for greater accountability at current support levels, the foregoing practice appeared inadequate. What seemed to be needed was an account structure that identified and grouped separately the services offered by schools. Such a structure would better enable the public and its legislative representatives to assess more precisely the actual cost and value of the services that schools were providing. Examination of existing program structures indicated that besides the service of instruction and its supporting activities, schools were also providing services for food, health, and transportation, as well as for student and general community activities. Because those services are non-instructional, they should not be prorated to the cost of an instructional program, but costed separately.

The budget chart of accounts developed in this study incorporates the foregoing rationale. It also adapts various aspects of the program accounting procedures recommended by the California State Department of Education Manual for Planning, Programming, and Budgeting Systems.[18] The following schematic skeletally illustrates the budget chart of accounts used. It defines four distinct levels: Level I, district, high school or community college; Level II, general service grouping; Level III, service grouping; and Level IV, program grouping. In the following paragraphs each level and its function in the account structure are discussed.

Level I, for purposes of this study, limits the cost analysis rationale to high school and community college districts. That limitation, however, does not exclude this structure from future adaptation for use at elementary or university levels.

Level II identifies the three general service groupings: direct costs of instruction, indirect costs of instruction, and non-instructional costs. These three groupings provide the basic framework for identification of those accounts that are:

a. directly charged to an instructional program

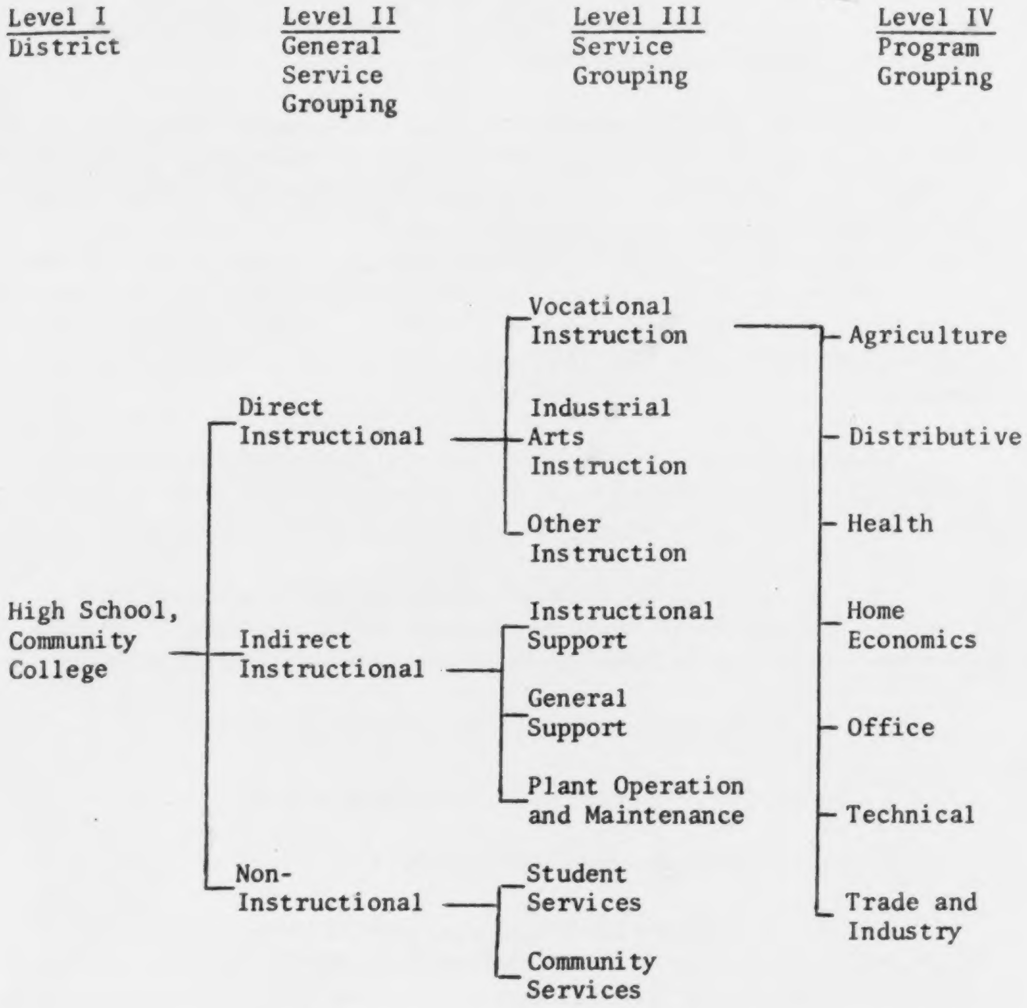
b. prorated by some variable to an instructional program

c. not charged to an instructional program

Level III illustrates the service groupings and their relationship to Level II. Those services provided the functional framework into which expenditure accounts of an institutional financial statement were classified. Each service grouping and its objects of expenditures are identified and discussed below.

Direct instruction comprises the three Level III curricular services: other instruction, industrial arts instruction, and vocational instruction. Such classification is required so that the cost of vocational programs can be differentiated from the cost of other instructional programs. To illustrate the need for such differentiation, the following is cited. Industrial arts programs were reasoned to be similar in cost to the high-cost vocational programs, because their class sizes and facilities were approximately the same. However, by Federal regulation their cost may not be classified with that of vocational education.[19] On the other hand, inclusion of the

PROGRAM STRUCTURE FOR COST ANALYSIS OF VOCATIONAL INSTRUCTIONAL PROGRAMS


Level I
District
Level II
General Service Grouping
Level III
Service Grouping
Level IV
Program Grouping
High School, Community College
Direct Instructional
Indirect Instructional
Non-Instructional
Vocational Instruction
Industrial Arts Instruction
Other Instruction
Instructional Support
General Support
Plant Operation and Maintenance
Student Services
Community Services
Agriculture
Distributive
Health
Home Economics
Office
Technical
Trade and Industry

cost of industrial arts as part of the cost of other instructional programs would inflate the cost of the latter and produce a low, imprecise cost ratio of vocational education to other instructional programs. Industrial arts service within the sampled high school districts is therefore classified separately. (The sampled community college districts do not offer that curricular service.)

Objects of expenditure within direct instructional service account for about 65 percent of the cost of instructional programs. The objects identify those costs that are attributed to specific resources consumed in the process of rendering a specific instructional service. In this study, the following objects are so classified:

1. Directors', consultants', and supervisors' salaries
2. Teachers' salaries
3. Secretarial and clerical salaries of those directly assisting directors, supervisors, and teachers
4. Other salaries of instruction (teaching aides)
5. Textbooks to include:
   a. new adoptions
   b. supplementary books
   c. workbooks
6. Teaching supplies
7. Replacement of instructional equipment
8. Cost of other items consumed in instruction

Examination of the above accounts reveals several changes in the traditional instruction object classification. First, objects such as the salaries of principals, of their secretarial and clerical staffs, and of other instructional staff (librarians, guidance and psychological personnel), as well as costs for libraries and audiovisual materials, are omitted on the basis of the fact that none of those accounts can be charged directly to a specific instructional service. Each account has to be either omitted from instructional charges or prorated on the basis of a precise proration variable. Second, salaries for directors and expenses for replacement of instructional equipment are added to the direct cost of instruction. Instructional equipment replacement can be easily identified as part of a specific instructional program, and is so charged. However, why include the salary of a director who probably performs duties similar to those performed by other administrative personnel? The rationale for that addition is as follows: To provide vocational education usually mandates the performance of additional administrative services. The program requires special reports to qualify for state and Federal categorical aids. Moreover, the program requires large amounts of special equipment and supplies that increase administrative burdens related to equipment procurement and maintenance. Inclusion of those additional administrative burdens within general administration costs would obscure the actual costs of providing vocational education as an instructional service. Therefore, the account for directors' salaries is added as a direct cost of instruction.

Indirect instructional costs comprise the three services: Instructional Support, General Support, and Plant Operation and Maintenance. Those service groupings provide a structure wherein objects prorated in a similar manner can be classified (proration procedures are described in the next subsection). Identification of objects within each indirect service group follows.

Instructional Support includes those objects that have as their purpose assistance to teachers or the general improvement of the curriculum. Objects in that service are:

1. Librarians' salaries
2. Audiovisual personnel salaries
3. Instructional television personnel salaries
4. School libraries and audiovisual materials
5. Inservice training
6. Sabbatical leave
7. Curriculum development, including district directors of curriculum and their staffs
8. Tutorial services
9. Attendance services
10. Commencement

General Support includes those objects that provide district-wide or institution-wide administrative, technical, and logistical support. The objects so classified are:

1. Administration, to include salaries of most district administrators, their assistants, secretarial and clerical personnel, and supplies:

    a. Board of Education
    b. Superintendent
    c. Business services
    d. Personnel services
    e. Warehousing and distribution
    f. Data processing

2. Principals' Salaries, to include Vice Principals, as well as secretarial and clerical personnel assisting them.

3. Fixed Charges:

    a. Contributions to employee retirement
    b. Insurance
    c. Rental of land and buildings

Plant Operation and Maintenance includes objects for general upkeep and physical operation of school buildings. Objects within that service are:

1. Salaries of grounds and building personnel

2. Costs of replacing non-instructional equipment

3. Utilities

4. Custodial supplies, etc.

5. Other expenses

The Level III non-instructional service grouping comprises the Level III services: student service and community service. The purpose of that grouping, as stated previously, is to identify to the public those non-instructional services that schools are providing. Classified within Student Services are the following:

1. Salaries of guidance and psychological personnel

2. Health services

3. Transportation services

4. Food services

5. Student body activities

Grouped within Community Services are the objects:

1. Recreation
2. Civic activities
3. Public libraries
4. Custodial and detention care of children

Separate identification of the above services not only enables clearer assessment of their value, but it also eliminates a potential problem of double financial reimbursement. For example, most states provide separate categorical aid for school transportation. However, if transportation were also prorated and included within the cost of vocational education, districts would in addition be receiving some of their vocational categorical funds on the basis of the cost of transportation. Thus, double reimbursement would occur.

To summarize Level III briefly, eight groupings are identified: three types of direct instructional service; instructional support; general support; plant operation and maintenance; student services; and community services. These groupings enable more meaningful classification of expenditure objects reported in currently used function-object fiscal reporting documents.

The reader may have noted that any consideration for capital expenditures and debt service has been omitted from the above discussion. Practices in public school accounting dictate the omission, for the concept of depreciation has seldom been used except for the purpose of determining the insurable value of buildings and equipment. In some instances, however, state support for pupil transportation has included an amount for the depreciation of school buses. The practice of permitting annual payments to a school district for depreciation of school buses is based upon the assumption that the school district will accumulate a replacement reserve that will be available when the bus is to be replaced. Experience has indicated, however, that such reserves become the target of demands for reductions in the school tax rate or for increases in teachers' salaries. Consequently, a reserve fund has seldom been retained for its intended purpose, and most states and districts prefer that the state contribute toward the purchase of transportation equipment during the same year the school district actually makes a purchase.

Similarly, if the state is to contribute to the purchase of instructional equipment for vocational education, the contribution should be made when the equipment is purchased – not as annual allowances for depreciation during the life of the equipment. Therefore, the cost of depreciation of vocational equipment must not be included in determining an allocable program-cost difference. Current practices mandate the separate identification of a vocational program's current and capital costs. This study, however, identifies differences only in current costs of vocational and other instructional programs.

Finally, Level IV of the program structure illustrates the seven program groupings of the vocational education curricular service as identified by the USOE and as uniformly interpreted for reporting purposes by all states and by all local districts. Level IV represents the highest degree of cost analysis in this study and is the level at which unit costs of vocational programs are calculated.

Proration of Indirect Costs. Utilizing the preceding program structure, this study ascertains costs for other instructional and industrial arts service at Level III and for vocational education services and programs at Levels III and IV. Costs within the above include, as previously indicated, only objects of direct expenditure. Because the total cost of an instructional program and non-instructional service includes both direct and indirect costs, this study has developed formulas for prorating the indirect service costs within Level III to services and programs at Levels III and IV. Current non-instructional services were found not to be extensively provided by school districts. As a result, in this study indirect support costs were prorated solely to instructional services and programs. However, if in the future non-instructional services expand, then indirect support costs should be prorated to them in proportion to the burdens that they create.

In the first section of this chapter it was stated that, although agencies have suggested usage of different variables to prorate the various indirect accounts, the current field and research practices in allocating indirect expenditures are imprecise. The account structure developed in this study classifies indirect costs into three services: Instructional Support, General Support, and Plant Operations and Maintenance. That classification provides an easy grouping of accounts that can be prorated by utilizing a ratio similar to, but more precise than, existing ratios. Subsequent paragraphs explain the rationale for prorating each of the aforementioned indirect services.

Instructional Support includes activities aimed at improving the quality of teaching and the curriculum. Cost accounts for school libraries, audiovisual services, and curriculum development are assigned to that service. Because these activities are designed to benefit the student, it is logical to allocate those costs in proportion to the amount of instructional service each program provides. A good measure of the amount of instruction provided is the Annual Student Contact Hour of Instruction (ASCH). That measure is defined as the product of the total course enrollment, hours per week of instructional contact, and number of weeks that the instruction was provided. To allocate the Instructional Support Service costs to the vocational instructional service, the following formula is utilized:

$$\frac{\Sigma \text{ ISASCH}}{\Sigma \text{ AISASCH}} \qquad (1)$$

where

ISASCH represents a specific Instructional Service's Annual Student Contact Hours within the district.

AISASCH represents All Instructional Services' Annual Student Contact Hours within the district.

To distribute the Vocational Instructional Support costs determined above the separate vocational programs, the following formula is used:

$$\frac{\Sigma \text{ VPASCH}}{\Sigma \text{ VISASCH}} \qquad (2)$$

where

VPASCH represents the district Annual Student Contact Hours within a specific vocational program.

VISASCH represents the district Vocational Instructional Service Annual Student Contact Hours.

The General Support Service provides district-wide or institution-wide administrative, technical and logistical support. The kinds of accounts assigned to this service include fixed charges, superintendents' salaries, principals' salaries, personnel services, and business services, i.e., objects more directly related to the support of instructional staff than to students or the instruction they receive. On this basis it appears that a measurement of the number of full-time-equivalent teachers can best allocate the expense of the General Support Service to instructional services and programs. Utilizing such a measurement, the following formula is employed to allocate that service's costs to the vocational instructional service:

$$\frac{\Sigma \text{ ISFTET}}{\Sigma \text{ AISFTET}} \qquad (3)$$

where

ISFTET represents a specific Instructional Service's number of Full-Time-Equivalent Teachers within a district.

AISFTET represents All Instructional Services' number of Full-Time-Equivalent Teachers within the district.

To distribute the Vocational General Support costs (determined above) among the separate vocational programs, the following formula is used:

$$\frac{\Sigma \text{ VPFTET}}{\Sigma \text{ VISFTET}} \qquad (4)$$

where

VPFTET represents a specific Vocational Program's number of Full-Time-Equivalent Teachers within a district.

VISFTET represents the district Vocational Instructional Services' number of Full-Time-Equivalent Teachers.

The final indirect service to be prorated to instructional services and programs is Plant Operation and Maintenance. An appropriate measurement for allocating that service expense, as identified by the United States Office of

Education Accounting Handbook is square footage.[20] The basic rationale for that measurement is that the dominant Plant Operation and Maintenance costs, custodial salaries, and utilities consumption are directly proportional to square footage.

School facility measurement standards include two types of square footage – classroom and ancillary (halls, lavatories, principals' offices, etc.). A possible concern is whether one type of square footage can achieve an adequate proration of the Plant Operation and Maintenance expense. For example, if the institutional square footage of ancillary services were large, proration of their Plant Operation and Maintenance costs by classroom square footage alone would result in an inflated program allocation. However, a recent survey in the State of Washington indicates that the use of one type of square footage is justifiable.

During the 1969-70 school year, the Washington State Department of Education conducted an extensive facility usage survey in its school districts.[21] In a sample of 18 high schools, the survey showed that classroom square footage comprises 68 percent of the total school square footage. On the basis of that information and discussions with state representatives from each of the participating states in this study, the ancillary square footage to classroom square footage ratio of 30:70 was assumed for all districts. In a subsample of six districts, a test was conducted to determine whether allocation of Plant Operation and Maintenance costs using the square footage ratio produced a large unit cost difference when compared to the unit cost produced by using only classroom square footage. The results indicated an average one-cent lower cost per annual student contact hour for the square-footage ratio. It was therefore assumed that proration utilizing only classroom square footage would not result in an unjust cost distribution. The following formula is used to distribute Plant Operation and Maintenance costs among the instructional services:

$$\frac{\Sigma \text{ ISCSF}}{\Sigma \text{ AISCSF}} \qquad (5)$$

where

ISCSF represents a specific Instructional Service's Classroom Square Footage within the district.

AISCSF represents All Instructional Services' Classroom Square Footage within the district.

To allocate the Vocational Plant Operation and Maintenance costs (determined above) among the separate vocational programs, the following formula is used:

$$\frac{\Sigma \text{ VPCSF}}{\Sigma \text{ VISCSF}} \qquad (6)$$

where

VPCSF represents a specific Vocational Program's Classroom Square Footage within a district.

VISCSF represents the district Vocational Instructional Services' Classroom Square Footage.

Base Unit of Measurement. To identify clearly the difference in cost among vocational programs, industrial arts service, and other instructional services necessitated the identification of an appropriate base unit of measure. Stevens and Elliott identified several reasons for utilizing the student contact hour instead of the credit hour as a base unit.[22] Shymoniak, in The Analysis of Costs and Effectiveness of Vocational Education Programs in Three Selected California Community Colleges, points out that the ratio of contact hours to credit hours varies significantly from school to school and from program to program.[23] He presents the following table showing the ratio of weekly contact hours to credits for various instructional programs in three community colleges.

TABLE 2-1 Ratio of Contact Hours of Instruction Per Semester Unit of Credit, By Program and College

Program	College A	College B	College C	Average
General Education	1.31	1.41	1.21	1.31
Agriculture	----	----	1.49	1.49
Distributive	----	1.00	1.34	1.17
Office	1.29	1.00	1.22	1.17
Health	2.64	1.73	2.24	2.19*
Technical	1.62	1.46	1.58	1.55
Trade & Industry	1.44	1.46	1.58	1.49

*A recalculation of this average reveals it to be 2.20.

Table 2-1 indicates that if credits were used as the base unit of cost comparison, vocational costs (with the exception of the Office and Distributive programs) would be inflated when compared to general costs. To correct that problem and clearly identify the cost difference between the vocational and other instructional services, this study uses the annual student contact hour as its base unit of comparison. This unit is derived by employing the following formula:

$$\text{ASCH} = \Sigma \text{SE} \times \text{HOI} \times \text{WIC} \qquad (7)$$

where

ASCH	represents Annual Student Contact Hours per course
ΣSE	represents Annual Student Enrollment in course
HOI	represents Hours per Week of Instruction in course
WIC	represents Weeks in Course

Cost Estimation Formula. In the first section, state and local educational administrators' need for a vocational program cost estimation formula was described and the cited research indicated that the development of a formula had been limited. Creation of an appropriate formula required the accomplishment of two tasks: a) the identification of variables that can adequately describe the cost of vocational programs, and b) the algebraic arrangement of those variables into an appropriate relationship. The accomplishment of those two tasks is described below.

Analysis of the cost of a vocational program suggested three variables that could affect estimates:

a. Teachers' salaries (the major expense of any instructional program)

b. Class size

c. Additional costs for supplies and replacement of equipment

Substantiation of the preceding was indicated by Keene, who stated that:

> To determine the weightings . . . two bases have been suggested in this study: class size and special laboratory equipment depreciation. In some school systems salary might be used as a differential component if a different salary scale is used for different types of programs.[24]

Anderson also verified:

> The average cost per student credit hour is a function of the following four factors: (1) salaries paid instructors of classes included in the curriculum, (2) the teaching load of instructors in total contact hours, (3) class size, and (4) cost of supplies and other supportive services for teaching.[25]

Cage additionally suggested:

> One possible solution is to weight the programs in the area schools according to cost, as determined by the factors of enrollment, salaries, supplies, etc. . .[26]

With the foregoing as a basis, listed below are the formula variables used in this study.

Vc represents the total cost per annual student contact hour of the vocational instructional service or programs in the district

$\overline{C}$ represents the average cost per annual student contact hour of all instructional services in the district (contained within this variable are the average program direct and indirect costs)

$\overline{N}$ represents the average student-faculty ratio for all instructional services in the district

N represents the average student-faculty for a vocational program in the district

K represents a mean program factor that reflects unusual requirements of the vocational program not related to class size (i.e., additional supplies, equipment, and indirect costs, etc.)

The algebraic arrangement of the above variables used in this study was initially conceived by Lindman.[27] He suggested that the per-student cost of a vocational program is equal to the average instructional cost per student times the ratio of the average class size for all services to the average class size for the vocational program, plus a program factor. This was expressed symbolically as:

$$Vc = \overline{C}\,(\overline{N}/N + K) \qquad (8)$$

In his work, Vc, $\overline{C}$, $\overline{N}$, N, and K were defined in a slightly different manner; however, their adaptation to the preceding variable definitions can be made. Regarding the formula, Lindman stated, "While it appeared to have possibilities, additional research is needed to test how accurately it predicts costs." The procedures described in the foregoing subsections provided the unit costs of vocational programs. Those costs were then used to test the above formula.

Data Collection

Analysis of vocational program costs, utilizing the aforementioned procedures, required selection of a large sample of school districts. The investigator decided that, given limitations of time and money, three high school districts and one community college district from each of seven states would provide a satisfactory sample. States and districts that participated (Appendix II-A) were chosen from the sample of 15 states that participated during the first phase of this project.

Collection of data for this study necessitated the development of data-collection instruments and the training of individuals in their use. Copies of the instruments that were involved in this study appear in Appendix II-B. Fellow researchers were trained in the collection procedures and sent out in two-man teams to each district to collect and record the necessary data. Among the important data items collected were: (1) direct expenditures of vocational programs; (2) total district expenditure; (3) master class schedule for each school in the district; (4) floor area of classrooms used for instruction by the different services and programs within the district; and (5) the number of full-time-equivalent teachers for services and programs in the district.

Statistical Procedures. Program unit costs and the K factors were determined with the aid of Worksheets I and II (Appendix II-C). The program unit costs were then utilized to ascertain whether the cost estimation formula accurately estimated costs. This was determined by first calculating the sum of squared differences between a vocational program's actual cost and its mean cost per ASCH for each school. Similarly calculated was the sum of the squared differences between the actual cost and estimated cost per ASCH. Those sums were then compared. A reduction in the actual and estimated squared difference from the actual and the mean square difference would prove that the estimation formula variable relationships were further analyzed. The analysis was accomplished by examining the correlations among the formula variables computed by a statistical program within the Statistical Package for the Social Sciences.[28]

ANALYSIS OF DATA

Analysis of Vocational Service and Program Instructional Costs

This section provides comparisons among the unit costs of instructional services and among the unit costs of instructional programs. The comparisons result from application of the cost-determining procedures to data provided by the sampled districts. In addition, use of the procedures provides a comparison of instructional costs in high schools with those in community colleges. The data tables presented herein are summaries of tables that led to determining the instructional costs and cost ratios in each of the sample districts (Appendices II-D and II-E).

Classification of District Expenditure Objects. Sampled high school and community college districts in this study reported their current expenditures in the traditional function-object manner. In order to make the analysis for this study, reclassification of the expenditure objects into the General Service and Service Groupings described in the program accounting structure was required. Table 2-2 illustrates the total district reclassification of those objects into that account structure.

TABLE 2-2 Summary of Current Expenditures for Selected High School and Community College Districts, FY 1969-70

Expenditure Grouping	High Schools		Community Colleges	
	Amount	%	Amount	%
Total Direct Instruction	52,518,416	60	11,267,355	56
Other Instructional Programs	39,837,736	45	7,673,685	38
Industrial Arts	3,131,406	4	None	None
Vocational Education	9,549,274	11	3,594,270	18
Total Indirect Instruction	27,468,845	31	6,988,023	35
Instructional Support	3,183,312	4	881,539	4
General Support	13,803,291	15	4,026,780	21
Plant Operation & Maintenance	10,482,242	12	1,979,704	10
Total Non-Instructional	7,810,120	9	1,850,122	9
Student Services	7,558,843	9	1,059,622	5
Community Services	251,277	0	790,500	4
TOTAL	87,797,381	100	20,105,500	100

Source: Derived from district data.

In both high school and community college districts, Direct Instructional Costs comprise the largest portion of the total current expenditures (60% in high schools, 56% in community colleges). In descending order within the districts are the percentages for Indirect Instructional Costs and for Non-Instructional Costs. As shown in Table 2-2, high schools and community colleges spent the same percentage of current expenditures for Non-Instructional Costs and for Instructional Support Costs. Differences, however, existed in service percentages for Instruction, General Support, and Plant Operation and Maintenance. The major percentage cost difference was between General Support Costs in high school districts and in community college districts. The 6 percent greater cost in community colleges for General Support can be attributed primarily to the salaries paid the additional administrative staff. For example, in high school districts, a specific high school may be fortunate to have as administrative personnel (besides the superintendent's staff) a principal, two vice-principals and a registrar. However, in addition to the superintendent's staff of a community college district, few colleges are without a president, several deans of instruction, and a dean of admissions, as well as individuals in charge of college business and personnel affairs.

Classification of the district total current expenditures into the three broad General Service Groupings and eight Service Groupings provides two major benefits. First, as previously stated, it enables the public to assess more clearly the value of the instructional and non-instructional services that schools are providing. Second, the account structure serves as a basic framework for classifying indirect instructional costs so that they can be more accurately prorated to the cost of instructional services and programs.

Proration of Indirect Cost. Determination of the total cost of an instructional service and program requires an appropriate allocation of indirect instructional costs. Three indirect service costs are identified: Instructional Support, General Support, and Plant Operation and Maintenance. Allocation of those costs proportionately to the burdens created by each instructional service and program requires ratios comprised of the following variables: Annual Student Contact Hours, Number of Full-Time-Equivalent Teachers, and Classroom Square Footage. Table 2-3 illustrates the mean ratios for prorating the indirect service costs to the vocational instructional service in the sampled high schools and community colleges. Despite the large deviations about those means, some consistencies are noted among the values of the table. First, the highest mean ratio for both sampled high schools and sampled community colleges is vocational classroom square footage to total classroom square footage. That ratio indicates that the classroom square footage for the average vocational course tends to be larger than the average classroom square footage for all courses. Second, the lowest mean ratio for both sampled high schools and sampled community colleges is vocational annual student contact hours to total

TABLE 2-3 Proration Percentages for Indirect Instructional Service Costs, FY 1969-70

Criterion	High Schools*		Community Colleges	
	Mean	Std.Dev.	Mean	Std.Dev.
Vocational Service's ASCH to All Services' ASCH	13.6	4.4	28.8	10.8
Vocational Service's FTET to All Services' FTET	17.5	6.2	36.9	9.5
Vocational Service's CSF to All Services' CSF	26.2	11.3	47.1	13.5

*Data for district 3E are not included in the calculation of these figures. The school within district 3E is primarily a vocational high school and is not comparable to the comprehensive high schools in the other districts.

Source: Derived from district data.

annual student contact hours. Third, the mean ratio of number of vocational full-time-equivalent teachers to number of total full-time-equivalent teachers is consistently larger than the ASCH ratio for both sampled high schools and sampled community colleges. The relationship of the preceding two ratios indicates that vocational class sizes are smaller than class sizes for all instructional services. Fourth, both sampled high schools and sampled community colleges provide sufficient differences among the three ratios (CSF, FTET, and ASCH) to justify the separate proration of each indirect service cost. The table clearly indicates that proration of all indirect costs solely by either enrollment or contact hours achieves a reduced cost allocation not proportional to the burden created by the vocational instructional service and programs. Finally, the reader may note that the mean ratios for the sampled community colleges are approximately twice those for the sampled high schools. The disparity indicates that the vocational service offered within the sampled community college districts is generally far more extensive than that offered in the sampled high school districts.

Once proration criteria for an instructional service are established, their application to the appropriate district indirect cost makes it possible to identify the indirect costs of a service. Adding those costs to the direct cost of the instructional service provides the total cost of the instructional service.

Total Vocational Service Cost. Table 2-4 shows both the direct and the indirect expenditures that together comprise the total cost of vocational instructional services within the sampled high school and community college districts. In both high schools and community colleges, direct expenditures make up the larger portion of the total service cost. The largest direct expenditure is that for teachers' salaries, which represent 54.3 percent of the total service cost in high schools and 42.4 percent in community colleges. Instructional supply costs are comparable at the two levels, comprising 3.2 percent of the total vocational service cost in high schools and 3.5 percent in community colleges. In most instances, other direct expenditures represent even smaller percentages of the total service cost. However, the reader may note that within community colleges, total expenditure for replacement, rental, and maintenance of instructional equipment accounts for approximately 8 percent of the total cost. Comparison of the preceding percentages to their respective percentages in high school districts reveals that during 1969-70, the sampled community college districts were spending a greater amount than were the sampled high school districts for vocational equipment replacement, rental and upkeep. Those data suggest a possible need for increased emphasis on vocational equipment replacement and upkeep in high school districts. In addition, the larger community college equipment expenditures explain, to a large extent, the lower percentage of the community college total vocational service cost attributable to teachers' salaries.

TABLE 2-4 Total Instructional Service Costs For Vocational Education, FY 1969-70

Expenditures	High Schools		Community Colleges	
	Amount	%	Amount	%
Total Direct	9,549,274	65.9	3,594,270	59.9
Directors' Salaries	241,057	1.7	159,211	2.6
Supervisors' Salaries	403,848	2.8	87,569	1.5
Teachers' Salaries	7,864,945	54.3	2,545,651	42.4
Secretaries' Salaries	146,670	1.0	67,113	1.2
Other Salaries	49,020	.3	13,416	.2
Textbooks	104,982	.7	629	0
Supplies	460,909	3.2	207,532	3.5
Repair of Equipment	135,671	.9	184,871	3.1
Rental of Equipment	18,233	.1	66,073	1.1
Maintenance of Equipment	11,730	.1	233,184	3.9
Travel	85,441	.6	14,885	.2
Contractual Services	17,165	.1	14,136	.2
Other	9,603	.1	0	0
Total Indirect	4,942,068	34.1	2,414,365	40.1
Instructional Support	375,835	2.6	213,227	3.5
General Support	2,170,431	15.0	1,401,788	23.3
Plant Operation & Maint.	2,395,802	16.5	799,350	13.3
TOTAL	14,491,342	100.0	6,008,635	100.0

Source: Derived from district data.

TABLE 2-5 Annual Student Contact Hours for Indicated Instructional Services and Programs, FY 1969-70

Instructional Services & Programs	High Schools		Community Colleges	
	Number	%	Number	%
All Services	109,635,061	100.0	11,663,109	100.0
Other Instructional Programs	91,473,602	83.4	8,874,092	76.1
Industrial Arts Service	5,475,599	5.1	None	None
Vocational Educ. Service	12,685,860	11.5	2,789,017	23.9
Agricultural Programs	741,215	5.9	35,896	1.3
Distributive Education	1,081,283	8.5	249,323	9.0
Office Education	4,202,839	33.1	812,568	29.1
Health Education	152,078	1.2	423,416	15.2
Home Economics Education	3,169,011	24.9	97,196	3.5
Technical Education	50,076	.4	613,195	21.9
Trade & Industry Programs	3,289,358	26.0	557,423	20.0
Total Vocational	12,685,860	100.0	2,789,017	100.0

Source: Derived from district data.

Examination of indirect costs of vocational services in the high schools and community colleges produces three findings. First, General Support Costs and Plant Operation and Maintenance comprise nearly all of the indirect costs. Second, those indirect costs (with the exception of the direct costs for teachers' salaries) comprise the largest percentages of the total cost of vocational services. Third, General Support Costs constitute a larger percentage of the total vocational service expenditure in community colleges than in high schools. This finding is commensurate with the higher general administrative expenditures in community colleges.

After the identification and analysis of the total cost of an instructional service and program, their unit costs must be determined to enable comparisons among services and among programs. Before analyzing the unit costs, it is first necessary to examine the base unit of measurement used to determine those costs.

Base Unit of Measurement. The Annual Student Contact Hour, as previously stated, is the base unit of measurement used in this study. It not only permits meaningful comparisons of unit costs, but also serves as a good measure of the amount of instruction provided in a service and program. Table 2-5 illustrates the aggregates of the annual student contact hours for instructional services and vocational programs in the sampled high school districts and in the sampled community college districts. On the basis of student contact hours, community college districts devote twice as much of their total programs to vocational instruction as do high school districts. That finding is compatible with data shown in Table 2-3. Further, within the sampled high school districts, the vocational programs providing the most extensive instructional service are Office, Trade and Industry, and Home Economics. In the sampled community college districts, the vocational programs providing the most extensive instructional service are Office, Technical, Trade and Industry, and Health.

Unit Costs. As previously described, instructional service and program unit costs are determined by dividing costs by their annual student contact hours. Table 2-6 illustrates the mean instructional service and program unit costs for the sampled high school and community college districts. In the sampled high school and community college districts, the current mean unit cost of vocational education is higher than the current mean unit cost of other instructional programs. In addition, the mean unit cost of industrial arts, offered only in the high school districts, is also higher than the mean unit cost of other instructional programs.

The vocational program mean unit costs indicate that in both high school and community college districts, all vocational programs are more expensive than other instructional programs. The following two lists rank the vocational programs in both high school and community college districts from their highest cost to their lowest cost:

TABLE 2-6 Mean Cost Per Annual Student Contact Hour for Indicated Instructional Services and Programs, FY 1969-70

Instructional Services & Programs	High Schools			Community Colleges		
	Mean		Std.Dev.	Mean		Std.Dev.
All Services ($\overline{C}$)	.80	(23)*	.22	1.63	(7)*	.26
Other Instructional Programs	.74	(23)	.21	1.49	(7)	.38
Industrial Arts Service	1.05	(21)	.41	N/A	(0)	N/A
Vocational Educ. Service	1.08	(23)	.30	2.21	(7)	.19
Agricultural Programs	1.69	(18)	.60	2.22	(3)	.60
Distributive Education	.92	(23)	.40	2.03	(4)	.85
Office Education	1.01	(23)	.52	2.02	(7)	.31
Health Education	2.26	(8)	2.16	2.40	(5)	.85
Home Economics Education	1.18	(22)	.64	2.13	(5)	.15
Technical Education	2.18	(2)	1.08	1.97	(6)	.49
Trade & Industry Programs	1.67	(23)	1.62	2.71	(6)	.90

*Number of sampled districts offering instructional service or program.

Source: Derived from district data.

High School	Community College
1. Health	1. Trade and Industry
2. Technical	2. Health
3. Agriculture	3. Agriculture
4. Trade and Industry	4. Home Economics
5. Home Economics	5. Distributive
6. Office	6. Office
7. Distributive	7. Technical

Comparison of the above rankings shows considerable variation in program placement. For example, in high school districts Technical programs incur the second highest unit cost, whereas in community college districts they are the lowest unit cost program. Trade and Industry programs in the high school districts rank fourth in cost, but in the community college districts they rank first.

Analysis of Table 2-6 discloses the fact that the community college mean instructional service costs are twice the high school mean costs. This finding for other instructional programs can be explained primarily by differences in teachers' and administrators' pay scales and lower student-faculty ratios. (The mean average for teacher's salary is $9,272 in the sampled high school districts, and $10,786 in the sampled community college districts. As Table 2-8 demonstrates, the mean class size in the sampled high school districts is 19 percent higher than in the sampled community college districts.) The mean cost difference between the high school vocational service and the community college vocational service is also 100 percent. An additional important factor is the emphasis on high-cost programs in community college districts. Table 2-5 shows that in high school districts, vocational programs in Office, Trade and Industry, and Home Economics are the major student contact programs. Those high school vocational programs, however, rank sixth, fourth, and fifth,respectively, according to program unit costs. In community college districts, the major vocational student contact programs are Office, Technical, Trade and Industry, and Health. Those programs rank sixth, seventh, first, and second, respectively, in community college unit costs. The preceding data indicate that in high school districts the lower-cost vocational programs are dominant. However, in community college districts the dominant vocational programs are divided between the higher- and the lower-cost programs, producing a higher mean cost.

Finally, the differences within programs produce extensive variations in program unit costs among districts. For example, one district may offer a Technical program made up of comparatively low-cost courses in radio and television repair. However, another district may offer a Technical program made up of high-cost courses in computer and missile systems repair. The extensive deviations in costs within programs suggest the possible ineffectiveness of mean program weighting factors in vocational cost distribution formulas.

Cost Ratios. The first section identified the fact that Federal vocational moneys are to be allocated by states to local districts to meet the difference in costs between vocational programs and other instructional programs. One facet of this study is to develop procedures to assist state and local educational administrators in determining accurate current cost differences. Those procedures have previously been described. Their application resulted in program unit costs identified in Table 2-6. Table 2-7 illustrates the mean cost ratios or cost differentials between the unit costs of vocational programs and those of other instructional programs. Examination of the table reveals that high school and community college total vocational service cost ratios are quite similar (1.54 in high schools, 1.57 in community colleges). Those data suggest that if the Federal funds are used only to support the "excess" cost of vocational education, then the same excess cost ratio may be used for high schools and community colleges.

Table 2-7 also shows the range of vocational program costs in high schools to be wider than in community colleges (1.30 – 3.10 in high schools, 1.44 – 2.00 in community colleges). In addition, industrial arts has almost the same cost ratio as vocational programs (I.A., 1.47; Voc. Ed., 1.54), suggesting the possible need for providing categorical support for industrial arts instruction.

Finally, the table shows that the deviations from the mean cost ratios are large. Those data substantiate the finding, suggested by the deviations in program unit costs, that the cost ratio mean should not be used as a weighting in the distribution of vocational funds to local districts.

Analysis of the Vocational Cost Estimation Formula

The purpose of the development of a vocational cost estimation formula is to provide state and local educational administrators with a simple tool to estimate and control appropriations and allocations of vocational costs. The formula developed in this study is described earlier in the first section. On the basis of the unit costs identified in the previous subsection, an analysis of that formula is presented below.

Variables. Tables 2-6 and 2-8 illustrate the mean values of the formula variables. The variable C is identified in Table 2-6 as the unit cost for All Services. The variables N, represented by All Services class size, and N, represented by the respective vocational program class size, are identified in Table 2-8. The mean class size for vocational instruction is shown to be smaller than that of other instructional programs and that of all services in both high school and community college districts. Further, community college vocational class sizes are smaller than high school vocational class sizes. Industrial arts class sizes are also slightly smaller than the mean class size for the high school vocational service.

TABLE 2-7 Mean Cost Ratios Between Indicated Instructional Services and Programs and O.I.P., FY 1969-70

Instructional Services & Programs	High Schools			Community Colleges		
	Mean		Std.Dev.	Mean		Std.Dev.
Other Instructional Programs	1.00		....	1.00		....
Industrial Arts Service	1.47	(23)*	.42	None	(0)*	None
Vocational Educ. Service	1.54	(23)	.46	1.57	(7)	.41
Agricultural Programs	2.67	(18)	1.43	1.65	(3)	.40
Distributive Education	1.30	(23)	.61	1.51	(4)	.46
Office Education	1.42	(23)	.66	1.63	(7)	.67
Health Education	3.10	(8)	2.98	1.93	(5)	.75
Home Economics Education	1.73	(22)	1.28	1.44	(5)	.25
Technical Education	2.91	(2)	1.29	1.68	(6)	.82
Trade & Industry Programs	2.39	(23)	2.15	2.00	(6)	.75

*Number of sampled districts offering instructional service or program.

Source: Derived from district data.

TABLE 2-8 Mean Class Size for Indicated Instructional Services and Programs, FY 1969-70

Instructional Services & Programs		High Schools		Community Colleges	
		Mean	Std.Dev.	Mean	Std.Dev.
All Services ($\bar{N}$)		24.5	3.2	20.9	3.9
Other Instructional Programs		26.3	2.9	22.1	4.8
Industrial Arts Service		20.3	3.2	None	None
Vocational Educ. Service		21.0	3.0	19.3	3.0
Agricultural Programs	(N)	15.3	4.2	18.7	5.1
Distributive Education	(N)	22.9	7.4	23.7	10.3
Office Education	(N)	22.6	3.5	22.2	4.3
Health Education	(N)	20.0	6.9	17.6	.8
Home Economics Education	(N)	20.4	3.2	18.5	8.4
Technical Education	(N)	16.9	3.2	16.3	4.5
Trade & Industry Programs	(N)	20.3	3.2	16.2	4.6

Source: Derived from district data.

The following lists rank the vocational programs in both high school and community college districts, from those with the largest class size to those with the smallest class size.

High School	Community College
1. Distributive	1. Distributive
2. Office	2. Office
3. Home Economics	3. Agriculture
4. Trade and Industry	4. Home Economics
5. Health	5. Health
6. Technical	6. Technical
7. Agriculture	7. Trade and Industry

Despite smaller class sizes in the community college districts, the rankings of the programs are quite similar.

Deviations from the class size means are generally small; exceptions are the deviations in Distributive programs in both high schools and community colleges, Health programs in high schools, and Home Economics programs in community colleges.

K Factor. Table 2-9 illustrates the mean K's applied in formula (8) to estimate the vocational program costs. In the construction of formula (8) the researcher assumed that there would be only small deviations from the mean K's; however, deviations are larger than the program means in both high school and community college districts. Those data suggest the inappropriateness of establishing constant vocational program factors for costs other than class size. Cost variations within programs are too great.

Testing Formula (8). Table 2-10 makes comparisons in each of nine instructional categories: industrial arts service; vocational service; and seven vocational programs. In each instructional category, it compares (a) the sum of the squared difference between actual cost and mean cost per ASCH with (b) the sum of the squared difference between actual cost and estimated cost per ASCH. The program cost estimated by the program mean cost, for the sum of the squared differences between the actual cost and the mean cost, is smaller than the sum of the squared differences between the actual cost and the estimated cost. Formula (8), with only a few exceptions, is totally ineffective, although exceptions are industrial arts service and vocational Office programs in high schools and vocational Agriculture and Distributive programs in community colleges. In those programs, formula (8) did calculate a slightly better estimate of the actual cost than did the program mean.

TABLE 2-9 Mean K Factor for Indicated Instructional Services and Programs, FY 1969-70

Instructional Services & Programs	High Schools		Community Colleges	
	Mean	Std.Dev.	Mean	Std. Dev.
Industrial Arts Service	.09	.30	None	None
Vocational Educ. Service	.22	.38	.31	.33
Agricultural Programs	.70	1.11	.37	.30
Distributive Education	.02	.53	.36	.43
Office Education	.20	.56	.30	.24
Health Education	1.35	2.66	.21	.49
Home Economics Education	.37	1.14	.11	.39
Technical Education	.79	.93	.18	.42
Trade & Industry Programs	.62	1.71	.44	.56

Source: Derived from district data and formula (8).

TABLE 2-10 Comparison of the Sum of the Squared Differences Between Actual Cost and Mean Cost per ASCH and Actual Cost and Estimated Cost per ASCH for Indicated Instructional Services and Programs, FY 1969-70

Instructional Services & Programs	High Schools		Community Colleges	
	$\sum\left(\text{Actual Cost} - \text{Mean Cost}\right)^2$	$\sum\left(\text{Actual Cost} - \text{Estimated Cost}\right)^2$	$\sum\left(\text{Actual Cost} - \text{Mean Cost}\right)^2$	$\sum\left(\text{Actual Cost} - \text{Estimated Cost}\right)^2$
Industrial Arts Service	34,344	15,068	None	None
Vocational Education Service	19,961	22,342	2,129	21,319
Agricultural Programs	60,939	92,191	7,201	5,656
Distributive Education	34,750	35,032	21,689	15,778
Office Education	60,312	54,408	3,748	10,470
Health Education	326,287	470,461	29,172	33,088
Home Economics Educ.	88,010	101,540	940	16,969
Technical Education	11,705	12,850	12,087	26,682
Trade & Industry	574,870	575,018	40,945	47,285

Source: Derived from district data.

However, the general ineffectiveness of formula (8) leads to an analysis of the variable relationships that the formula assumed true:

> First, one must assume that the cost of a vocational program within a district is directly related to the cost to the district of other instructional programs. The validity of that assumption depends upon highly positive correlation coefficients between the two program costs. Table 2-11 shows the correlation coefficients between those variables. With only a few exceptions, there is an extremely low correlation between the variables. These data suggest that rather than a strong direct relationship existing between the cost variables, no relationship exists at all.
>
> The second necessary assumption is that a strong relationship exists between the cost of an instructional program and its class size. That relationship could be illustrated by highly negative correlations between a program's cost and its class size. Table 2-12 illustrates those correlation coefficients, which indicate that in community college Agriculture, Distributive, and Trade and Industry programs the correlations are highly negative. However, in general, the correlations between cost and class size in high schools and community colleges are not highly negative. Those data suggest that rather than a strong inverse relationship existing between the variables, little or no relationship exists.

Data in Tables 2-11 and 2-12 suggest the reason for formula (8)'s ineffectiveness. It is interesting to note, however, that in community college Agriculture and Distributive programs, where the variable relationships held true, formula (8) did calculate a better estimate of the program cost than did the program mean cost.

FINDINGS

The data presented in the preceding two subsections are summarized as follows:

1. District Current Expenditures
    a. In both the sampled high school and the sampled community college districts, Direct Instructional Costs comprise the largest portion of the total current expense. Indirect Instructional Costs and Non-Instructional Costs comprise the remainder of the total district current expenditures.

TABLE 2-11 Correlation Between Cost per ASCH for Indicated Instructional Services and Programs, FY 1969-70

Instructional Services & Programs	High Schools		Community Colleges	
	All Services	O.I.P.	All Services	O.I.P.
Industrial Arts Service	.724	.565	None	None
Vocational Educ. Service	.468	.261	-.433	.119
Agricultural Programs	-.001	-.109	.921	.696
Distributive Education	.329	.282	-.405	.560
Office Education	.269	.176	.562	.273
Health Education	.102	-.046	-.614	-.292
Home Economics Education	.084	.012	-.252	-.008
Technical Education	----	----	-.013	-.286
Trade & Industry Programs	.188	.029	-.426	.108

Source: Derived from district data using a statistical program from (SPSS).

TABLE 2-12 Correlation Between Cost per ASCH and Class Size for Indicated Instructional Services and Programs, FY 1969-70

Instructional Services and Programs	High Schools			Community Colleges		
	Services	O.I.P.	Programs	Services	O.I.P.	Programs
All Services	-.317	-.522		-.056	-.119	
Other Instruc. Programs	-.277	-.454		-.452	-.498	
Industrial Arts Service	.008	-.328		None	None	
Agriculture			-.316			-.913
Distributive			-.661			-.830
Office			-.271			-.393
Health			.617			-.247
Home Economics			-.232			-.656
Technical			----			.659
Trade & Industry			.267			-.789

Source: Derived from district data using a statistical program from (SPSS).

   b. Non-Instructional (9%) and Instructional Support (4%) cost percentages of the total current expenditures are the same in both the sampled high school and the sampled community college districts.

   c. General Support Costs in the sampled community college districts comprise a larger percentage of the total current expenditures than in the sampled high school districts.

2. Indirect Cost Proration Criteria

   a. In both sampled high school and sampled community college districts, the highest percentage proration criterion is the ratio of vocational classroom square footage to total classroom square footage.

   b. In both sampled high school and sampled community college districts, the lowest percentage proration criterion is the ratio of vocational annual student contact hours to total annual student contact hours.

   c. Located between the preceding proration percentages is the percentage of vocational number of full-time-equivalent to total number of full-time-equivalent teachers.

3. Components of Total Vocational Service Cost

   a. Teachers' salaries comprise the largest percentage of total cost of a vocational service. That percentage is followed by the Indirect Cost percentages for General Support and Plant Operation and Maintenance.

   b. In the sampled community colleges, larger percentages of total vocational cost are spent for instructional equipment replacement, rental, and maintenance than in the sampled high schools.

4. Annual Student Contact Hours (Base Unit)

   a. In the sampled high school districts, the vocational programs in which the greatest amount of instructional service occurred are Office, Trade and Industry, and Home Economics.

b. In the sampled community college districts, the vocational programs in which the greatest amount of instructional service occurred are Office, Technical, Trade and Industry, and Health.

c. On the basis of student contact hours, sampled community college districts devote twice as much of their total program to vocational instruction as do high schools.

5. Unit Costs

a. Vocational Service current costs are higher than costs of Other Instructional Programs in both sampled high school and sampled community college districts.

b. Industrial Arts Service current costs are higher than costs of Other Instructional Programs and slightly lower than costs of total vocational service in the sampled high school districts.

c. Ranked below, from highest unit cost to lowest unit cost, are the vocational programs in both the sampled high school and the sampled community college districts:

High School	Community College
1. Health ($2.26)	1. Trade and Industry ($2.71)
2. Technical ($2.18)	2. Health ($2.40)
3. Agriculture ($1.69)	3. Agriculture ($2.22)
4. Trade and Industry ($1.67)	4. Home Economics ($2.13)
5. Home Economics ($1.18)	5. Distributive ($2.03)
6. Office ($1.01)	6. Office ($2.02)
7. Distributive ($.92)	7. Technical ($1.97)

d. Community college mean other instructional programs and mean vocational unit costs are twice the high school mean other instructional programs and mean vocational unit costs.

e. There are large deviations from vocational program mean costs.

6. Cost Ratios

a. Cost ratios of the total Vocational Service in sampled high school districts are quite similar to those in sampled community college districts (1.54 in high schools, 1.57 in community colleges).

b. In high schools, cost ratios of Industrial Arts Service are similar to cost ratios of vocational services.

    c. In both high schools and community colleges, deviations from the mean cost ratios are large.

7. Vocational Cost Estimation Formula

    a. In both the sampled high school and the sampled community college districts, vocational class sizes are smaller than those of other instructional programs.

    b. Sampled community college vocational class sizes are smaller than sampled high school vocational class sizes.

    c. In the sampled districts, the standard deviations exceeded the corresponding means of the program K factor.

    d. In the sampled districts, the sum of the squared differences between the vocational program actual cost and mean cost is generally smaller than the sum of the squared differences between the vocational program actual cost and the formula estimated cost.

    e. In the sampled districts, there is minimal direct relationship between the cost of a vocational program and the cost of other instructional programs.

    f. In the sampled districts, there is minimal inverse relationship between the cost of a vocational program and its average class size.

CONCLUSIONS

The first section of this chapter noted that states must consider the difference in a local district's costs between vocational programs and those of other instructional programs in their allocation of Federal vocational funds. To comply with that Federal allocation criterion required that states and local educational agencies determine accurate vocational program unit costs. Procedures developed in this study were conceived to assist state and local administrators in the accomplishment of that task.

The sample of districts in which those procedures were applied to gather vocational program cost data was not random. Consequently, findings cannot statistically be generalized to all high school and community college districts. However, the size of the sample and its representative nature suggest the potential for general applicability.

Conclusions drawn from the findings in the sampled districts are as follows:

First, appropriate proration of indirect costs for General Support and for Plant Operation and Maintenance is critical in determining the precise total cost of an instructional service. Distribution of those costs in proportion to the burdens that the instructional services create requires a combination of proration ratios. However, if, for simplicity of proration, a single ratio were required, the findings suggested that an instructional service's number of full-time-equivalent teachers to total number of full-time-equivalent teachers be selected as the single best approximation of the indirect cost calculated by the combined ratios.

Second, high school districts place less emphasis on instructional equipment replacement and maintenance for vocational education than do community college districts. The findings do not indicate in either high school or community college districts the extent of such programs. However, the findings do indicate that, as a percentage of the total vocational service cost, community college districts' replacement and maintenance of instructional equipment expenditures were seven times those of high school districts.

Effective equipment replacement programs are mandated by rapid changes in equipment technology. Obsolete equipment can greatly reduce the effectiveness of the training received in vocational programs.

Third, current unit cost differences between vocational programs and other instructional programs suggest, on the basis of cost only, the continuation of vocational categorical support. The findings reveal that in both high school and community college districts, all vocational programs cost more than other instructional programs.

Fourth, the finding that high school mean vocational service costs are half those of community college mean vocational service costs should not lead to the conclusion that high schools have more effective vocational programs than community colleges. This study examined only the costs of programs. The effectiveness of a program is dependent upon several additional factors. For example:

a. whether completion of the program actually provided the student with a saleable skill;

b. whether completion of the program reduced the individual's job-search time;

c. whether completion of the program provided the individual with additional earning power;

d. whether the program meets the vocational desires of students.

Each of the above must also be evaluated along with cost before drawing any conclusion about the actual effectiveness of the community college vocational programs.

Fifth, the data findings suggest that strong consideration be given to additional financing for industrial arts service. Industrial arts courses permit exploratory vocational experiences that greatly assist an individual in the choice of an occupation, and also the training appropriate to that choice. In many of the sampled high school districts, the differences between a vocational course and an industrial arts course were: (a) the qualifications of the instructor, (b) depth of inquiry inherent in the course, and (c) length of time that students spent in the course. Similarities between the two services were (a) facilities, (b) class size, and (c) identified unit costs. With the preceding as suggested evidence, it would seem appropriate that as the concept of career education takes form, both vocational education and industrial arts service should be parts of that concept.

Sixth, the findings reveal the ineffectiveness of the suggested vocational cost estimation formula. Potential failure of the formula was indicated by finding such a great cost fluctuation within each vocational program that it was impossible to establish a specific program constant. Furthermore, the finding that no direct relationship existed between a vocational program's cost and the cost of all instructional services invalidated a basic assumption of the formula. The combination of those factors led to the imprecision of the formula.

Finally, the above two findings also suggest that vocational program weighting factors are neither sufficiently sensitive to local needs, nor precise enough to be used in a state vocational fund's allocation system. Such factors, however, can still be used for determining gross cost estimates for purposes of establishing general appropriation levels.

RECOMMENDATIONS

On the basis of the preceding conclusions, the following six recommendations are made to administrators of vocational education and to the legislative representatives of the people.

1. Adaptation of the program accounting structure used in this study should be considered by state and local educational administrators. Such a structure enables the public to assess more precisely the actual cost and value of the services that schools are providing.

2. Specific Federal guidelines should be established for prorating indirect costs among instructional programs. Without such guidelines, states will continue to use widely varying procedures, thus severely hindering compilation of accurate national totals of vocational program costs.

3. State vocational administrators should thoroughly examine vocational instructional equipment replacement and maintenance policies within their states. Specific attention should be directed toward replacement policies at the high school level. Separate financing of instructional equipment replacement within state and Federal vocational categorical support should be considered.

4. State vocational administrators should conduct cost-effectiveness studies that compare high school and community college vocational programs. Costs alone do not indicate the effectiveness of vocational programs. However, if an educational institution can provide vocational programs at a lower cost, without sacrificing attainment of skill, then continued financial support of similar programs at a higher cost must be re-evaluated. A methodology for conducting cost-effectiveness studies is described in Chapter IV.

5. State and Federal legislators should strongly consider increasing vocational current categorical support to include the current cost of industrial arts service. This study suggests that, in many instances, costs of industrial arts service are similar to those of vocational programs. Industrial arts also serves as an initiator of an individual's interest toward a specific vocational field. It would seem appropriate that within the funding of career education and/or vocational education, industrial arts should be included.

6. State vocational administrators should consider a three-component system for estimating and controlling vocational program costs. The study revealed the ineffectiveness of the tested formula and usage of

program weighting factors. Neither was sufficiently sensitive to local needs, nor precise enough in estimating local vocational program costs. However, the study did identify three major current cost areas of vocational programs:

a. certificated salaries

b. indirect costs

c. replacement of instructional equipment and unique supplies in support of that equipment

On the basis of the preceding, a three-component system that is sensitive to local district needs, yet provides cost controls for the state, is suggested. The components of such a cost estimation system are described below.

The first component is certificated salaries. For each vocational program, a district would report:

a. Number of Program Teaching Positions

b. Number of Program Supervisory Positions (prorated on-time spent)

c. Annual Salary Requirements for indicated number of positions, based upon an approved salary schedule.

d. Average Daily Attendance in program classes

To determine the actual program salary cost would require the state to ascertain an appropriate percentage figure for estimating the cost of sick leave and other fringe benefits. Multiplying that figure times the program salary requirement and then adding the result of that requirement would provide a district program salary estimate. Control of that estimate could be achieved by the state's determination of approved class size levels for each vocational program. Division of the reported program average daily attendance by the reported program number of teaching positions determines the district program class size. Comparison of the state and district class sizes would determine whether the state would provide financing for the number of program teaching positions requested by the district.

The second component is for support of indirect costs. Those costs vary greatly from district to district. To control excessive program overhead, it is suggested that the state determine a support figure. Calculation of such a figure for high schools or community colleges would require:

a. State Total Current Expenditures

b. State Total Expenditures for Pupil Services

c. State Total Expenditures for Community Services

d. State Total Expenditures for Salaries of Teachers and Supervisors

e. Total Number of Teachers

Subtraction of the expenditures for Pupil Services, Community Services, and Salaries of Teachers and Supervisors from the Total Current Expenditures identifies the state total indirect cost. This study revealed that the best single variable to use in distributing indirect costs to programs is the number of full-time-equivalent teachers. On the basis of that information, division of the state total indirect cost by the total number of teachers would provide the best program support unit. A district program support cost could then be calculated by multiplying the state unit times the number of program-approved teachers and supervisors.

The third component is the instructional equipment replacement and supply cost. To determine that cost would require districts to identify types of equipment and supplies and their costs. To establish some basis of control for such requests would probably require states to develop program equipment replacement schedules. In-depth discussion of the preceding appears in Chapter III.

Addition of the three program components produces an estimate of the total cost of a vocational program within a district. Accountability is maintained by the control mechanisms incorporated into each component. A suggested application of the system appears in the following figure.

District Vocational Program Budget Request

School District: ______________________ Program: ____________________

School Year: __________________________

	Actual Current Year	Estimated Ensuing Year
I. Salary Component		
A. Number of Program Teaching Positions	______	A ______
B. Number of Program Supervisory Positions (prorated by time spent)	______	B ______
C. Total Program Positions (A+B)	______	C ______
D. Annual Salary Requirements for Indicated Number of Positions Based upon Approved Salary Schedule	______	D ______
E. Estimated Amount Required to Finance Sick Leave and Other Approved Fringe Benefits (D x approved state percentage figure)	______	E ______
F. Total Salary Component (D+E)	______	F ______
G. Program Average Daily Attendance	______	G ______
H. Student-Faculty Ratio (F/A)	______	H ______
II. Support Component		
Number of Approved Program Positions x State Support Component	______	______
III. Equipment Replacement and Supply Component		
A. Equipment		
Nomenclature		
1. ______________________________	$______	$______
2. ______________________________	$______	$______
B. Supplies		
Nomenclature		
1. ______________________________	$______	$______
2. ______________________________	$______	$______
C. Total	$______	$______
IV. Total Program Component (IF+II+IIIC)	$______	$______

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CHAPTER III

FINANCING THE ACQUISITION AND REPLACEMENT OF INSTRUCTIONAL EQUIPMENT

E. Charles Parker

THE PROBLEM OF OBSOLESCENCE

The need for expensive instructional equipment in vocational education shops and laboratories contributes significantly to the higher cost per student in these courses. In addition to the equipment acquisition and replacement problem of the public schools have been the demands on the school budget for salary increases, for smaller classes, and for tax reduction — all generally considered more urgent.

In recent years, for example, the problem has become critical because of the need for expensive electronic equipment that must be replaced more frequently. The electronic calculator in Office Education, electronic equipment in Trade and Industry, and computer equipment in data processing are three cases in point.

Lambert[1] portrays the current fiscal plight of education:

> Caught between rising costs and lagging revenue, school systems of all sizes are retrenching — sometimes drastically. Although not all school systems are affected yet, some, like that of Los Angeles, have cut back on the number of teachers and shortened the length of the school day. Others, like the one in Independence, Missouri, have closed when out of funds. Some of the largest systems — Chicago and Philadelphia, for example — face the possibility of running out of funds and ending the school year early or of borrowing against next year's revenues. Others have cut specialized teachers and staff for programs in art, music, health services, reading, libraries, driver education, counseling, and physical education. Many have reduced allowances for substitute pay, teacher aides, and maintenance of school buildings.
>
> Cost cutting, such as this, is keeping the schools going — but just barely and at a sacrifice in the quality of education.

Rapid changes in technology and increased replacement costs in electronics and other fields are causing much of our laboratory equipment to become obsolete long before it is worn out. Industry endeavors to replace equipment before its value is lost by technological obsolescence. Yet industry is having its own problems of obsolescence and shortage of funds as indicated by William T. Hogan.[2]

> Inflation has boosted the cost of replacing machinery and equipment, often to a figure two to three times that of the original cost of the equipment to be replaced, and in turn has placed increased importance upon internally generated funds for capital replacement. Technological developments due to greater activity in research and development have been so rapid in many industries that much machinery is obsolete long before its anticipated life has expired, and consequently, before its original cost is charged off. As a result, industries both large and small have found it difficult to adjust their replacement programs to the rapid rate of technological progress. The use of machinery that is outmoded has often been reflected in lower productivity, higher operating costs and lower profits.
>
> One of the biggest obstacles to the replacement of obsolete equipment is the lack of sufficient funds to do the job.

For tax benefits and cost analysis, industry annually depreciates its equipment, usually setting up a reserve account that will have sufficient funds available when the time comes for replacement.

Public schools, on the other hand, can gain no tax benefits from depreciating their instructional equipment. Experience has taught the local school administrator that reserve funds will soon be sought out by pressure groups to be used for other purposes. Increased costs of education have caused administrators to make present equipment "do for another year or two" until the degree of obsolescence in the high schools creates serious deficiencies in many vocational education training programs. Wattenbarger declared in his study that:

> Some of the 'expense' in occupational programs is not necessarily in the direct cost of the equipment, but in the indirect cost to students who were trained on obsolescent equipment.[3]

In response to a questionnaire, most of the state directors of vocational education indicated that replacement practices were generally inadequate in their states.

These facts all point to the need for a planned approach to financing the acquisition and replacement of instructional equipment for vocational education laboratories.

ESTIMATED VALUE OF INSTRUCTIONAL EQUIPMENT USED IN HIGH SCHOOL VOCATIONAL EDUCATION PROGRAMS

Although it is obvious that the instructional equipment required for vocational education laboratories is more expensive than equipment used in most general education courses, little information is available concerning actual costs of such equipment.

Some state departments of education were able to provide equipment lists for various programs. Table 3-1 summarizes costs reported by the states for recommended instructional equipment in various programs, the number of states supplying the data, and the total number of schools reported by the USOE as having vocational programs. The investment for each program indicates the approximate cost of equipping laboratories to meet current "recommendations."

In order to estimate how much money high schools actually spend to equip vocational education laboratories, a detailed study of the cost of equipment in actual use in ten high schools was undertaken. Teachers and/or department heads in four California and six Utah high schools were asked to take an inventory of their laboratories. The ten schools consisted of four large (1,001 and over), four medium-sized (500 to 1,000), and two small (1 to 499) schools; they were selected by specialists and administrators in each of the two states.

The inventory consists of instructional equipment (1) currently being used in the laboratories, (2) limited to items costing $100 or more, unless the cost is just under $100 and there are large numbers of the item, and (3) all furniture, regardless of the cost. The following data were collected for each item of equipment:

Original cost

Predicted useful life (PUL)

Estimated trade-in value

Purchase date

The inventories of the schools are not necessarily a recommended equipment standard, but they do reflect current conditions in vocational laboratories.

Using the inventory data collected from the ten high schools, inflation values were added to the original cost of each item of equipment to bring its original cost to a 1970 value (the latest USOE figures available). An average cost of each program in the ten schools is given in Table 3-2, along with the total number of programs indicated by the USOE reports. The estimated national investment in vocational education equipment obtained on this basis is $1,193,000,000. Although the estimates in Tables 3-1 and 3-2 are based on limited evidence, the great difference between them suggests that high school laboratory equipment does not meet recommended standards and that a better plan for financing the purchase of equipment is needed.

TABLE 3-1 Total Cost of Equipping High School Vocational Education Laboratories at Current Prices Based on Equipment Lists Recommended by Selected State Departments of Education

Program	Number of States	Average State Recommended Investment Per Program	National Total Number of Schools with Programs	Estimated National Investment
(a)	(b)	(c)	(d)	(e)
Agriculture	4	$ 24,091	8,696	$ 209,495,000
Distributive	3	7,748	4,452	34,494,000
Health	4	21,943	1,612	35,372,000
Home Economics	3	38,894	14,455	562,213,000
Office	6	50,884	9,174	466,810,000
Technical	8	202,476	1,273	257,752,000
Trade & Industry	6	101,856	6,130	624,377,000
TOTAL		$447,892		$2,190,513,000

Source: Column (c)--Data obtained from the State Boards of Vocational Education in the following states: Alabama, California, Kentucky, Maine, Ohio, Texas, Utah, and Virginia.
Column (d)--United States Office of Education, Vocational & Technical Education, Annual Report, FY 1969 (Washington: Government Printing Office, 1971).
Column (e)--Column (c) times Column (d).

TABLE 3-2 Estimated National Investment in Vocational Education Instructional Equipment at Current Prices Based on Average Investment per Program in Ten High Schools and Number of Programs Reported by USOE

Program	Average Investment per Program	National Total Number of Schools with Programs	Estimated National Investment (to nearest thousand)
(a)	(b)	(c)	(d)
Agriculture	$23,829	8,696	$ 207,217,000
Distributive	2,665	4,452	11,865,000
Health	1,249	1,612	2,013,000
Home Economics	12,993	14,455	187,814,000
Office	40,107	9,174	367,942,000
Trade & Industry	67,871	6,130	416,049,000
TOTAL			$1,192,900,000

Sources: Column (b)--Data obtained from vocational teachers in ten schools.
Column (c)--*Vocational and Technical Education, Annual Report, FY 1969*, USOE (Washington: Government Printing Office, 1971).
Column (d)--Column (b) times Column (c).

DEVELOPMENT OF REPLACEMENT SCHEDULES FOR HIGH SCHOOLS

There are six major factors that influence the replacement cost of instructional equipment. They are:

1. Number of years it will be used (PUL).
2. Trade-in value
3. Trend of increased or decreased costs due to inflation or deflation
4. Original cost of the equipment
5. Amount of use (contact hours) the equipment receives
6. Care and maintenance of the equipment

Three factors bear on the life of office equipment:

1. The physical life, or how long the equipment will last before wearing out
2. The application life, or how long the equipment will be used on the job for which it was purchased
3. The technological life, or how long the machine will last before it becomes obsolete

In vocational education, the technological life is related directly to the equipment used in industry, and indirectly to the new product coming on the market. All three factors must be considered in projecting replacement times of instructional equipment.

The trade-in value of equipment is difficult to determine. Many manufacturer representatives and educators would not even suggest a figure because there are so many variables. If equipment has a predicted useful life (PUL) of 15 years, for example, a number of factors will have an effect. The dealership that sold the original item may change hands, thus giving rise to new trade-in policies. If the item of equipment becomes obsolete because of technological change, its value may be reduced substantially. For the same technological reasons, a decision may be made to purchase a far more expensive piece of equipment, allowing the dealer a bigger margin, and thereby obtaining a larger trade-in allowance.

Inflation tendencies have been rather constant over the past few years. The consumer's price index for the past eight years has increased approximately 3 percent annually.[4] It is believed that the 3 percent rise will continue and estimates of replacement costs in this study are based upon this assumption.

The inventories of the ten high schools were used to project a ten-year average of annual replacement costs. A formula (page 83) that considered initial cost, trade-in value, PUL, and an inflation adjustment was applied to each item of equipment from the ten schools. The data were then computed and the results appear in Table 3-3.

A cost figure that represents the total investment in vocational equipment of these schools (Column B, Table 3-3) was obtained from the inventories supplied by their vocational teachers. Assuming that these ten schools are representative in the relationship of their replacement policies to their total investment in instructional equipment, a percentage figure can be used to estimate replacement costs of other total investment figures, including national estimates.

NATIONAL PROJECTIONS

With respect to the data already presented, national cost estimates can be projected that will reflect the magnitude of the instructional equipment problem.

New Program Costs. The USOE provides a listing of a total number of vocational programs in each issue of its annual report.[5] An average increase (or decrease) of these programs was determined each year, 1966 through 1969, to establish a trend or average change representing each year. These figures appear in Table 3-4. The recommended program costs provided by state departments of education were again used to show an optimum expense. Multiplying this amount by the annual increase or decrease in vocational programs obtains a product of $173,000,000.

Using the average program cost provided by the ten schools, a figure believed to resemble more closely actual equipment costs is obtained. Using the average program cost indicated by the ten schools, and the average increase or decrease in vocation programs, a product is obtained that is believed to approximate actual equipment costs for new programs. Table 3-5 indicates a total of $93,000,000 that should be expended annually to acquire instructional equipment for new vocational education programs.

Replacement Costs. Replacement costs of the ten high schools were calculated to be 5.6 percent of the total investment in instructional equipment (Table 3-3). This same percentage was used to project a national replacement cost by taking 5.6 percent of the nation's total investment in instructional equipment (Table 3-2).

A recapitulation of the total costs that can be anticipated nationally for vocational education instructional equipment appears below:

1. National estimated amount invested by public schools in instructional equipment for vocational education (Table 3-2)	$1,193 million

TABLE 3-3 Projected Annual Replacement Cost as a Percent of Total Investment of Vocational Education Instructional Equipment in Ten High Schools

Program	Total Investment	Projected Annual Replacement Cost	Annual Replacement Cost as Percent of Total Investment
(a)	(b)	(c)	(d)
Agriculture	$ 119,145	$ 5,787	4.9%
Distributive	10,660	155	1.5
Health	1,249	90	7.2
Home Economics	129,934	8,037	6.2
Office	401,067	30,706	7.7
Trade & Industry	678,713	30,483	4.5
TOTAL	$1,340,768	$75,258	5.6

Source: Columns (b) and (c)--Data obtained from inventories supplied by vocational teachers in ten schools. Column (d)--Column (c) divided by Column (b).

TABLE 3-4 Estimated Annual Cost of Equipping New Programs, Based on Equipment List Recommended by Selected State Departments of Education and the Average Number of New Programs Reported Annually by USOE for a Three-Year Period

Program	Average Cost per Program from State Recommendations	Average Number of New Programs Annually	Estimated National Annual Cost (to nearest thousand)
(a)	(b)	(c)	(d)
Agriculture	$ 24,091	0	$ ---
Distributive	7,748	471	3,649,000
Health	21,943	232	5,091,000
Home Economics	38,894	568	22,092,000
Office	50,884	757	38,519,000
Technical	202,476	114	23,082,000
Trade & Industry	101,856	790	80,466,000
TOTAL			$172,899,000

Source: Column (b)--Data obtained from State Boards of Vocational Education.
Column (c)--Vocational and Technical Education, Annual Report, FY 1969, USOE (Washington: Government Printing Office, 1971).
Column (d)--Column (b) times Column (c).

TABLE 3-5 Estimated Annual Cost of Equipping New Programs Based on the Average Cost per Program in Ten High Schools and the Average Number of New Programs Reported Annually by USOE

Program (a)	Average Cost per Program in Ten High Schools (b)	Average Number of New Programs Annually (c)	Estimated National Annual Cost (d)
Agriculture	$23,829	0	$ ---
Distributive	2,665	471	1,255,000
Health	1,249	232	290,000
Home Economics	12,993	568	7,380,000
Office	40,107	757	30,361,000
Trade & Industry	67,871	790	53,618,000
TOTAL			$92,904,000

Source: Column (b)--Data obtained from vocational teachers in ten schools.
Column (c)--USOE, Vocational and Technical Education, Annual Report, FY 1969 (Washington: Government Printing Office, 1971).
Column (d)--Column (b) times Column (c).

2.	National estimated annual cost of replacing present obsolete equipment and maintaining present program equipment quality (Table 3-3, 5.6% of $1,193 million)	$67 million
3.	National estimated annual cost of equipping new programs equal in quality to present program equipment (Table 3-5)	$93 million
4.	Total national estimated replacement and initial equipping costs, maintaining the present quality (2 plus 3)	$160 million

The foregoing estimates are based on the cost of equipment actually in use in ten high schools. If national equipment acquisitions and replacements were made to conform to state recommended standards, the estimated annual cost would be approximately $300 million.

The substantial difference between the cost of maintaining and replacing present instructional equipment and that of meeting "recommended standards" reflects the differences between equipment actually in use and equipment recommended by state departments of education. Although the estimates provide little more than an order of magnitude cost figure, they point to a significant problem: instructional equipment in the vocational education laboratories is not being kept up to date and a continued lag in this area will limit the effectiveness of these programs.

Development of Replacement Policies. The survey of state directors of vocational education revealed that 55 percent of the states had inadequate replacement policies. Boldt of California expressed the problem succinctly:

> The cause is one of inadequate inventory control with no system of depreciation and subsequently no idea of annual demands for replacement. The result is spasmodic rather than systematic.[6]

Perhaps the cause is despondency: why bother with the bookwork when there are no funds to achieve the objective? Mathias asked 155 school districts in California and Ohio that did not have replacement plans why systematic typewriter replacement schedules were not being used. Seventeen percent did not believe a replacement plan was needed; 61 percent were unable to finance such plans; and 14 percent had not yet organized or received approval of a plan. Although Mathias' study showed that 53 percent of the 346 districts surveyed had replacement plans, it does not indicate if these districts were able to follow the plan, or if they became a part of the 61 percent who were financially unable to support such a plan.

In light of the foregoing information, a study by Murdick[7] showing that a major proportion of industrial firms do not follow a prescribed replacement policy is noteworthy.

> A significant indication is that 56 percent of the firms responding said they have no special policy for determining whether capital equipment should be replaced. This compares with 21 percent who said they have a written policy and 23 percent who have unwritten policies.

An important factor in connection with replacement policies is the PUL of instructional equipment. PUL is difficult to determine; even though a stated number of years is meant to be a guideline only, people close to the problem hesitate to place a time schedule on their equipment. Mathias[8] and Wattenbarger[9] have both found wide discrepancies among estimates of the number of years equipment should be used.

An average PUL representing all the equipment in each program of the ten high schools is shown in Table 3-6. It was found by setting up separate categories of furniture and instructional equipment that furniture averaged about 20 years PUL and was generally a low-cost item. It was therefore decided to omit furniture from this calculation. The PUL shown in Table 3-6 is the average of what the department heads and vocational teachers felt ought to be the replacement time for each item of equipment.

The weighted average of 12 years equates to an 8 percent yearly replacement. A 12-year PUL compares favorably with the figure cited in the study conducted by Parry,[10] who used 13 as the average number of years equipment should be used. The Kentucky State Board of Education furnished a PUL summary for T & I equipment that averages 11 years, and Keene[11] used 10 years in his study of junior college vocational equipment.

Cost Projection. Assuming that the replacement of instructional equipment is necessary in order to avoid the disadvantages of obsolescence and rising maintenance costs, let us now look at the projection of equipment replacement costs for ten years. Where planned replacement policies are followed in order that maintenance and trade-in costs are controlled and equipment is kept current, the yearly projection becomes a useful and accurate indicator of replacement costs.

Table 3-7 presents a breakdown of the ten high schools by program, and identifies the estimated replacement cost of each year from 1970 through 1979. This same type of breakdown can be established for a school, district, or state by expanding the data fed into the computer. Tables 3-8 and 3-9 compare the estimated replacement costs for one large high school, with that for two other high schools, a large and a medium-sized. As can be seen, there is a decrease in the amount of fluctuation between annual costs as the number of schools increases.

TABLE 3-6 Replacement Status of Instructional Equipment* of Vocational Education Programs in Ten High Schools

Program	Average Predicted Useful Life (PUL)
(a)	(b)
Agriculture	12
Distributive	13
Health	17
Home Economics	10
Office	9
Trade & Industry	15
Average (Weighted)	12

Source: Data obtained from inventories taken by teachers of ten high schools.

*Furniture was omitted from the calculations in this table.

TABLE 3-7 Projected Annual Replacement Costs for Vocational Education Instructional Equipment for Ten High Schools

Year (a)	Agriculture (b)	Distributive (c)	Health (d)	Home Ec. (e)	Office (f)	T & I (g)	Total (h)
1971	$ 3,358	$ -	$ -	$ 9,838	$13,962	$15,249	$ 42,407
1972	15,257	316	-	4,897	18,467	13,329	52,266
1973	5,038	-	-	5,525	19,636	9,130	39,329
1974	5,443	-	-	15,931	32,492	34,252	88,118
1975	16,716	302	-	6,809	60,910	36,640	121,377
1976	13,855	133	-	10,345	47,966	61,386	133,685
1977	2,479	104	-	7,568	26,967	41,431	78,549
1978	14,906	213	73	5,413	58,950	19,354	98,909
1979	6,525	116	825	9,311	29,238	29,699	75,714
1980	27,751	365	-	15,385	36,529	51,531	131,561
Average	$11,133	$155	$ 90	$ 9,102	$34,511	$31,200	$ 86,192

Source: Data obtained from Vocational teachers in ten schools.

TABLE 3-8 Projected Annual Replacement Costs for Vocational Education Instructional Equipment for Two High Schools

Year (a)	Agriculture (b)	Distributive (c)	Health (d)	Home Ec. (e)	Office (f)	T & I (g)	Total (h)
1971	$ -	$ -	$ -	$ 1,522	$ 5,178	$ 5,197	$ 11,897
1972	-	198	-	2,128	7,347	985	10,658
1973	-	-	-	699	6,998	6,639	14,336
1974	175	-	-	11	13,723	1,320	15,229
1975	840	-	-	3,035	17,103	4,042	25,020
1976	1,206	-	-	1,928	9,446	24,568	37,148
1977	-	104	-	2,576	14,661	3,973	21,314
1978	1,318	213	-	1,203	18,977	3,835	25,546
1979	649	-	-	3,569	8,197	6,557	18,972
1980	919	-	-	3,521	11,424	21,014	36,878
Average	$ 511	$ 52	$ -	$ 2,019	$11,305	$ 7,813	$ 21,700

Source: Data obtained from vocational teachers in one large high school and one medium-sized high school.

TABLE 3-9 Projected Annual Replacement Costs for Vocational Education Instructional Equipment for One High School

Year (a)	Agriculture (b)	Distributive (c)	Health (d)	Home Ec. (e)	Office (f)	T & I (g)	Total (h)
1971	$ -	$ -	$ -	$2,359	$3,333	$ 5,697	$11,389
1972	-	118	-	451	590	3,157	4,316
1973	-	-	-	767	1,888	627	3,282
1974	-	-	-	481	3,466	970	4,917
1975	-	302	-	494	2,837	10,696	14,329
1976	-	-	-	523	5,347	1,499	7,369
1977	-	-	-	525	402	1,408	2,335
1978	-	-	-	539	2,492	782	3,813
1979	-	116	-	559	2,435	6,098	9,208
1980	-	-	-	574	2,415	4,094	7,083
Average	$	$ 54	$ -	$ 727	$2,520	$ 3,503	$ 6,804

Source: Data obtained from vocational teachers in one large high school.

The yearly fluctuations are a normal occurrence caused by mass purchasing of equipment to begin a new program, or because, unexpectedly, funds become available for large purchases.

Since the amount of equipment purchased is restricted by the relatively stable yearly budget, replacement expenditures should not fluctuate greatly from year to year when they are projected for budgeting and planning purposes. Unless a state-wide system of reimbursement for equipment purchases is established, equipment replacement needs will inevitably vary substantially from year to year.[12]

A formula was developed to project the replacement costs of instructional equipment, and it was used to compute the data for Tables 3-7, 3-8, and 3-9. The formula for estimating replacement costs is:

$$C_r = C_o (1-T)(1+I)^N$$

C_r Replace cost

C_o Original cost

T Trade-in value as a percentage of original cost

I Inflation correction, 3 percent per year

N Predicted useful life (PUL)

In order to project the replacement cost for each year over the next ten years for planning purposes, this formula must be applied to each item of equipment at the time of purchase.

Using Table 3-10, it is simple to demonstrate the operation of the formula. Suppose the district purchased a belt sander in 1961 for $170. Using a 10 percent trade-in value and an average PUL of 13, Table 3-10 indicates that the new cost factor is 1.323. Multiplying 1.323 by the original cost (C_o) gives a projected cost (C_p) in 13 years (1974) of $225, assuming a normal trade-in of 10 percent. As the equipment comes up on the schedule for replacement but has not been replaced, the replacement cost (C_r) becomes the original cost (C_o) for an additional projection which should normally be for one additional year. Table 3-10 assumes that the equipment is replaced on schedule at the adjusted cost (C_r) and is expected to have the same PUL.

CURRENT STATE POLICY FOR EQUIPMENT REPLACEMENT

A survey of state vocational directors was conducted to determine the policy of each state concerning the funding of initial acquisition and replacement of instructional equipment. A general questionnaire was sent in the form of a letter to all 50 vocational directors representing the 50 states. Forty-nine replies were received. Two additional questionnaires were sent to selected directors based on the

TABLE 3-10 Table for Estimating Cost of Replacing Equipment after "N" Years, Assuming a 3% Annual Price Increase and Indicated Trade-In

Years	Trade-In Value as Percent of Original Cost				
	20%	15%	10%	5%	0%
1	.824	.876	.927	.979	1.030
2	.849	.902	.955	1.008	1.061
3	.874	.929	.984	1.038	1.093
4	.901	.957	1.013	1.070	1.126
5	.928	.986	1.044	1.102	1.160
6	.956	1.016	1.076	1.135	1.195
7	.985	1.046	1.108	1.169	1.231
8	1.014	1.078	1.141	1.205	1.268
9	1.045	1.110	1.175	1.241	1.306
10	1.076	1.143	1.211	1.278	1.345
11	1.108	1.178	1.247	1.316	1.385
12	1.142	1.213	1.284	1.356	1.427
13	1.176	1.250	1.323	1.397	1.470
14	1.211	1.287	1.363	1.438	1.514
15	1.247	1.325	1.403	1.481	1.559
16	1.285	1.365	1.445	1.526	1.606
17	1.323	1.406	1.489	1.571	1.654
18	1.363	1.448	1.534	1.619	1.704
19	1.404	1.492	1.580	1.667	1.755
20	1.446	1.537	1.627	1.718	1.808

findings of the first questionnaire. One of these follow-up questionnaires went to each of the 33 respondents who represented states indicating that their local districts retain title to equipment; the other follow-up questionnaire went to each of six respondents who indicated that their state departments of education retain title.

This survey demonstrated that there are 34 states in which all the equipment is owned by local districts. In only two states, Hawaii and Mississippi, is all the equipment owned by the state. (Hawaii is unique in that it has no local school districts.) Four states indicated that they retain title, but own less than 100 percent of all the equipment. These four were classified with nine states whose respondents indicated that they share ownership of equipment with local districts.

Only three states do not provide state or Federal support to local districts for the initial acquisition of instructional equipment. It is generally apparent that locally owned equipment is not purchased solely with local funds. Forty-one states in this category make provisions for some kind of support to local districts for the acquisition of new instructional equipment. Initial acquisition is usually a capital outlay expenditure, a cost that is traditionally funded by states.

Of the 49 states replying, 34 provide funds for the replacement of instructional equipment. Although an actual number is unavailable, there were some indications that the funds supplied were limited, with many other priorities taking precedence over the replacement of equipment. A survey of any given year may show a smaller number of states funding the replacement of instructional equipment.

The fact that there are ten states that do not provide state or Federal funds for replacement of equipment contrasts with the three states that give no funds for initial acquisition. This difference in funding practices between the initial acquisition and replacement is indicative of the attitude of some state departments; they are letting the local district assume the expenses of ongoing programs once new programs have been initiated with the use of Federal and state funds.

The practice of replacing equipment with money that is exclusively Federal or state-originated is rather limited (four states). In contrast, states combining Federal and state funds to support the replacement of equipment are fairly numerous (23). This seems to indicate that replacement of equipment is done at the option of the local district, which sets the priorities and pays for replacement when it is needed. In many cases, the funds that go to local districts from states are not earmarked for purposes of equipment replacement. The use of extra allotments for the replacement of equipment, as pointed out by some states, is a policy of the state; but in actual practice, very little money is used by school districts for that purpose.

When an extra allotment is made, it is usually done on a matching basis. This practice is traditional for vocational education, based on past Federal acts that have supplied matching money for vocational programs.

RECOMMENDATIONS

1. State education agencies should establish standards for acquiring, maintaining, and replacing instructional equipment needed for vocational programs.

   Specifically, the State Department of Education should provide the following assistance to school districts (see Appendix III for procedure used in this study):

   a. Replacement schedules showing the projected useful life (PUL) of major items of equipment.

   b. Suggested equipment lists for major vocational laboratories with approximate retail costs.

   c. A suggested procedure for keeping adequate records of all instructional equipment.

   d. A system for projecting replacement costs for budgeting purposes.

   e. Advisory assistance to local school districts pertaining to equipment acquisition, control, and replacement.

2. State education agencies should develop a plan to reimburse local districts for the acquisition and replacement costs of major instructional equipment.

   Financing equipment replacement in most states is a local responsibility. However, there are some advantages in shifting this responsibility to the entire state:

   a. The annual replacement costs are less erratic as new inventory is added (see Tables 3-7 through 3-9).

   b. A larger system makes a computer operation more feasible and provides more pertinent information.

   c. Funding from state and/or Federal sources makes it unnecessary for local districts to accumulate reserve funds which have been traditionally difficult to maintain.

   d. A statewide system of purchasing, equipment exchange, maintenance, and leasing may have advantages in some localities.

There are several ways the state can assume financial responsibility for the acquisition and replacement of instructional equipment. Three plans are suggested:

a. State Ownership of Equipment. Under this plan the state would retain title to all major items of equipment. Replacement, acquisition, and maintenance would be the fiscal responsibility of the state. The state would assign instructional equipment to local school districts as needed for their approved vocational programs.

b. Full Reimbursement for the Cost of Instructional Equipment. School districts would submit application for reimbursement from the state for all major instructional equipment purchases. Approval would be based on the need and use of the equipment, and in accordance with equipment lists and replacement schedules supplied by the state.

c. Variable Percentage Reimbursement for the Cost of Instructional Equipment. This is currently the most common practice among states, but the replacement of equipment is often a low-priority item. State and/or Federal funds should be made available to assure adequate maintenance and replacement policies.

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CHAPTER IV

EVALUATION OF VOCATIONAL EDUCATION PROGRAMS THROUGH COST-EFFECTIVENESS ANALYSIS

Leonard R. Shymoniak

EXPENDITURE OBJECTIVES VS. ACCOMPLISHMENTS

One of the major weaknesses of current evaluation procedures in vocational education is their inability to relate expenditures for programs to their objectives and accomplishments. Although attempts to overcome this weakness may be viewed by some as an effort to reduce educational objectives to materialistic considerations, success in its resolution would greatly facilitate the planning process in vocational education. It would above all enable administrators to select alternative program options in terms of goal achievement and cost considerations. The need for incorporating both goal achievement (effectiveness) and cost considerations (efficiency) criteria into educational planning and decision-making is succinctly posited by Kaufman:

> Any evaluation which concentrates on the objectives achieved, and which disregards costs, is as faulty as any consideration which concentrates on costs and disregards the attainment of objectives.[1]

Although weaknesses in educational evaluation have disturbed educators for some time, little progress has been made toward resolving these limitations. This view is firmly held by one writer, who made the following assessment of the problem:

> Even with the increased emphasis on vocational education, both as an operative program and as a research area, it is still true that evaluative research and analysis – for example, research that relates inputs to outputs and that examines the relationship between the outputs of the system and the characteristics of the labor market – is difficult to undertake and has not provided a great deal of information that can be generalized. Thus, today, the state of affairs in research on vocational education is still not a happy one.[2]

The first major expression of concern over the inadequacies of evaluative practices in vocational education was voiced in 1963 by President Kennedy's Panel of Consultants on Vocational Education, which had just completed its study on the status of vocational education and had recommended a number of changes that were incorporated in the Vocational Education Act of 1963. In the section of their report summarizing the major needs for improvement, the Panel noted that:

> Lack of data and tangible evidence . . . made it difficult for laymen or professionals to fully evaluate the national program of vocational education. . . . Objectives and standards are quite valueless if, as criteria of appraisal, they cannot be compared with data that indicate whether or how efficiently purposes are being achieved.[3]

A similar attitude prevailed in other parts of the report:

> Research of an evaluative type which is fundamental to sound development has been . . . very limited. Little or no evidence has been gathered regarding the results or effectiveness of instruction given . . . [4]

> Research and study of operational efficiency have been neglected. Raising instructional effectiveness depends in large measure on research in operational efficiency, the implementation of research findings, and better utilization of instructional devices . . . [5]

In 1968, the National Advisory Council on Vocational Education published its report reviewing the progress in vocational education made during the five years following the report made by the Panel of Consultants. The Council's report, which itself was a product of evaluative procedures required by the 1963 Act, gave thorough consideration both to the achievements and the limitations of vocational education in the United States during that period, and played an important role in influencing the Vocational Education Amendments of 1968. As in the earlier report of the Panel, attention was drawn to the fact that existing evaluation practices in vocational education, though somewhat improved over 1963, were not entirely satisfactory, and there was little evidence to indicate that the basic purposes of the 1963 Act had been accomplished.

An excerpt from the report bears this out:

> A national reporting system has not been developed to an operational state to provide rapidly the statistical data needed for planning and evaluation . . . While some improvement has been made in the reporting of data, there are still many gaps in both quantity and quality.[6]

Current Follow-Up Practices

Yet three years after the enactment of the Vocational Education Amendments of 1968 there has been little evidence to indicate that significant changes, or improvements, in evaluation practices have taken place. The USOE continues to collect vocational follow-up data by requesting local educational agencies to complete USOE Form 4045, which requires collection of the following statistics on students completing occupational programs: (1) number not available for placement because of entry into armed forces, continuing education, and other reasons; (2) number in labor force employed full time and part time; (3) number unemployed and seeking work; (4) number whose status is unknown; and (5) number who left prior to normal completion of their program. This federally initiated survey provides some notion of vocational education output for evaluating institutional or district-wide programs in vocational education. However, the data collected are of limited usefulness for evaluating the effectiveness of institutional vocational education programs because:[7]

1. Data collected tend to pertain only to that period immediately following the student's graduation – a period often characterized by uncertainty and indecision.
2. Data on labor market performance of graduates are generally limited to job entry wage rates, thus precluding any consideration of the longitudinal effects of training.
3. Minimal effort is made to compare performance of vocational graduates to that of non-vocational graduates; thus, there is a failure to establish any norms.
4. Socio-demographic factors relating to the individual are not controlled where there is an attempt to determine the effects of vocational training on labor market experience.
5. Sampling procedures are rarely used when collecting accomplishment data on program graduates, although it should be pointed out that there is an apparent lack of resources even for such minimal research.
6. Conclusions on follow-up surveys are generally based on those graduates who respond to questionnaires, even though a low rate of return is realized.
7. The types of data collected only partially relate to the evaluation of vocational education in terms of objective accomplishment.
8. Few attempts are currently being made to relate costs of vocational education programs to their accomplishments, and this does not allow for any measure of effectiveness or efficiency.

Several conclusions are readily apparent from the above considerations. First, there is ample room for further improvement in the evaluative procedures. Second, there is some indication that when poor quality research occurs in vocational education, it may be attributable to lack of a sufficiently refined method for evaluating vocational program costs and accomplishments. Third, there is a need to expand the use of follow-up surveys so that they can (in addition to being a crude justification of expenditures) serve as a means for evaluating vocational education programs through cost-effectiveness analysis at the institutional level.

EVALUATION THROUGH COST-EFFECTIVENESS ANALYSIS

Needs of the Administrator

The most immediate use for follow-up data on vocational education graduates is not at the Federal or state level, but at the institutional level where change can be most readily effected. The school administrator, who occupies the focal position for influencing changes in vocational education programs at the institutional level, must first place the purpose of vocational education in proper perspective. Central to this is the concept of factor production as it relates to human resources. The two fundamental elements of this concept are that: (1) society requires different types of skills or human resources, and (2) an optimal combination of the various types of skills or human resources enables society to function more efficiently.[8] It follows, therefore, that the task of the administrator is to establish and conduct an educational program that provides opportunities for students to develop appropriate skills, and to ensure that the skills students acquire correspond to the needs of an efficiently functioning society.

In planning the well-balanced curriculum, the administrator should be aware of vocational education's benefits to the individual, the community, and society For the individual, vocational education provides a means for improving productivity through increased earnings and employment.[9] For the community, improved earning power and employment generate greater tax revenues, and, at the same time, reduce the likelihood that the individual will require social welfare.[10] Vocational education serves three other important functions in the community. First, it provides opportunities to those members of the community who have a desire to acquire a given type of training, and therefore satisfies private needs for members of a community. Second, it supplies trained personnel required by the local labor market. Third, it enables the community to benefit from the services rendered by trained individuals.[11] For society, vocational education has a part in promoting economic growth and stability. As skills become obsolete, vocational education trains and retrains personnel in new types of skills required by industries that are affected by advancing technology.[12]

To ensure that the individual, the community and society are all afforded maximum benefit through the school curriculum, the administrator requires continuous feedback information relating to at least two aspects of a program. The first of these is program effectiveness, wherein the administrator measures outputs to determine the degree to which existing programs are attaining their objectives. Among other things, the administrator's attention is directed at the following types of questions: What is the relative degree to which the different programs are attaining specified objectives? What weaknesses are present in existing programs that prevent more complete attainment of objectives? How can identified weaknesses of existing programs be overcome? Should resources be shifted away from a program that is ineffective?

The second aspect of evaluation concerns efficiency, wherein the administrator analyzes inputs to a program to determine the minimal cost at which a given level of accomplishment can be realized. The object of improved efficiency is to realize operational savings so that resources can be released to allow opportunity for other students and to improve other programs. More efficient allocation of resources is possible through the implementation of program cost-analysis techniques. Cost analysis assists the administrator in diagnosing the financial structure of programs to reveal discrepancies. Also, cost analysis can enable pricing of educational outputs so that resource allocation is rendered less arbitrary.

Program Evaluation for Decision-Making

Program evaluation is the process of measuring the relative desirability of alternative programs in terms of pertinent cost and accomplishment criteria in order to provide decision-makers with a rational choice among alternative courses of action for achieving some stated objective. One of the more comprehensive instruments for evaluating programs in either the private or the public sector is the Program Planning Budgeting System (PPBS).[13] PPBS is a combination of two operational techniques, program budgeting and systems analysis,[14] each of which is defined briefly below.

Program Budgeting. Two fundamental characteristics distinguish program budgeting from other traditional forms of budgeting.[15] First, program budgeting is an objective-oriented structure which presents expenditure data on activities of a program in categories which reflect that program's ultimate objectives. Second, program budgeting provides a structure for analyzing and planning current and projected resource requirements and predetermined outputs.[16]

Systems Analysis. A complementary tool for program budgeting, systems analysis is a form of quantitative analysis designed to provide a standard for decision-making so as to achieve rationality in planning. Alternative names for the different types of systems analysis, which share a common conceptual and methodological frame of reference, include cost-effectiveness analysis, cost-benefit analysis, cost-utility analysis, and operations research.[17] Although cost-effectiveness analysis is emphasized here, the terms "cost-effectiveness" and "cost-benefit" are used somewhat interchangeably. The following subsections set forth the meaning of these two terms.

Cost-Benefit Analysis. This evaluative technique attempts to relate the total benefits of a program to its total costs. There are two basic approaches for using cost-benefit analysis: first, maximizing benefits for a given level of costs; second, minimizing costs for a given level of benefits.[18] One of the underlying requirements in a cost-benefit analysis, whether in education or elsewhere, is that benefits as well as costs be expressed in monetary terms properly discounted to present values.[19]

Cost-Effectiveness Analysis. This type of analysis is a methodological framework for making numerical estimates of the effects of particular learning activities on selected variables and the costs of obtaining these effects. Although this technique is an extension of cost-benefit analysis, it de-emphasizes the economic (i.e., assigning dollar values to benefits) aspect of the approach, and therefore avoids many of the unresolvable conceptual and practical limitations encountered by cost-benefit analysis.[20]

Hardin discusses the type of output variables that are suitable for cost-effectiveness analysis of vocational education programs. These categories are divided into two groups: (1) those output variables that pertain to the trainee's performance at the end of training and can be measured by direct observation or by oral or written tests (trainee knowledge, skills, motivation, and other behaviors); and (2) those output variables that refer to the trainee's labor market performance (earning data, employment stability, labor force participation, skill level of regular job held, receipts of unemployment insurance benefits or welfare assistance, and geographic mobility).[21] Both cost-benefit and cost-effectiveness analyses proceed through at least five major steps: (1) specification of objectives; (2) determination of constraints; (3) elaboration of feasible alternatives; (4) measurement of costs and benefits; and (5) evaluation of alternatives.[22]

Literature on Cost-Effectiveness Analysis in Vocational Education

Although the number of cost-effectiveness analysis studies of manpower training programs have in recent years become more extensive, the number of similar studies relating to vocational programs in public schools have been rather limited. Some of the more important studies concerned with manpower training programs are collected in a volume by Somers,[23] and there is a critique of them in another volume edited by Somers and Wood.[24] In the latter volume, an article by Hardin[25] presents an in-depth comparative analysis of some of these more important manpower training studies.

The more significant cost-effectiveness studies attempted in the area of public school vocational education have been published subsequent to 1965 and were, for the most part, the outcome of funding provided by various government education agencies. After a considerable delay, it can now be noted that at least six cost-effectiveness studies of vocational education programs in secondary and post-secondary institutions have been completed. Warmbrod, in a 1968 monograph, reviews several of the earlier studies in vocational education along with other manpower training studies reported by Somers.[26] Two of these studies, as well as other related studies, are again reported in a supplement to *The Journal of Human Resources.*[27] Finally, a monograph by Little, which is primarily concerned with a review and synthesis of placement and follow-up of vocational education students, devotes a short section to an overview of several more recent cost-effectiveness analysis studies.[28]

Among the more important cost-effectiveness analyses of vocational education programs in the United States are those by Kaufman, et al.,[29] Kraft,[30] Corazzini,[31] Taussig,[32] Carroll and Ihnen,[33] and Persons, et al.[34] Kaufman, et al., provide a rationale for cost-effectiveness analysis and demonstrate its applicability to data gathered from secondary academic, vocational and comprehensive schools in three Pennsylvania cities. Kraft develops a cost-utility rationale and field-tests this rationale in two post-secondary vocational-technical institutes in Florida. Corazzini compares the cost of academic high school education with vocational high school education in Worcester, Massachusetts and calculates the economic benefits to the individual and the local community. Taussig reports a standard cost-benefit analysis of vocational education in the urban public high schools of New York City. Carroll and Ihnen report a study, conducted on a matched sample of graduates in North Carolina, designed to determine the social and private rates of returns of technical education in an adult area technical institute. Persons, et al., examined 3,518 farm records to detemine the investment returns of a farm business management program in Minnesota.

Although all of the above studies are concerned with cost-effectiveness analysis, their design and scope vary substantially. Each study treats differently such elements of cost-effectiveness analysis as defining and determining costs and benefits, control grouping, estimating differential effects of training, observation period and time trends, statistical method and data analysis. A complete review of these differences will not be made in this report. However, some generalized conclusions based on these differences are summarized by topic below.

Role of Cost-Effectiveness Analysis. The majority of cost-effectiveness analysis studies cited tend to place emphasis on determining whether vocational education is worthwhile; consequently, they seriously neglect adapting the technique for decision-making purposes at the institutional level. Either implicitly or explicitly, most of the studies assume, for the cost side of cost-effectiveness analysis, that programs are efficiently operated. Sound reasoning indicates, however, that educational programs are not necessarily efficiently operated. Moreover, it would seem thatthere is little justification on the part of educators to evade the entire area of program efficiency by assuming that fact. Although such an assumption greatly simplifies the process of evaluation, it contributes little to meaningful evaluation in vocational education.

A second variance in the purposes served by cost-effectiveness analysis relates to the size of the system being evaluated. In many of the studies cited, the system for which cost-effectiveness analysis is conducted bears little relationship to the system in which needed changes can be implemented. Because most significant change must occur at the institutional level, there is need to redirect future cost-effectiveness analysis studies to that level.

A final variance concerns the depth of the analysis required. Most studies have attempted minimal analysis of vocational education programs inasmuch as comparisons are attempted at the level of vocational education itself, rather than programs within vocational education. Apart from supplying information as to whether vocational education in general is a better alternative than non-vocational education, these studies have done little to provide the information required by administrators for improving specific programs within the total vocational education curriculum, or for allocating resources among the different vocational education programs.

Measuring Effectiveness. The majority of the studies cited in this report measure the effectiveness (or benefits) of vocational education solely in terms of earning data. Little attempt is made to determine the extent to which differences in earnings over a period of time are attributable either to high unemployment or low earning rates. Because the more important goal of vocational education pertains to the effect of training on reducing unemployment, a measure based strictly on earnings or job-entry wage rates is grossly inadequate. Cost-effectiveness analysis studies which resort entirely to job-entry wage rate or earning data as criteria for program evaluation are suspect and should not be continued.

Measuring Costs. An element of cost-effectiveness analyses that has been seriously neglected is the determination of vocational education program costs in institutions where vocational education is conducted simultaneously with general education. Because fiscal reports of public schools are recorded in terms of traditional budgetary categories (rather than program categories), most studies encountered difficulty in determining the cost of vocational education programs. The absence of a refined method for costing vocational education programs has greatly limited the scope and quality of studies in cost-effectiveness analysis.

Collection and Analysis of Follow-Up Data. There appears to be considerable discrepancy among studies, first, regarding the proper length of time over which follow-up of students should be made. At one extreme are those studies that utilize information based solely on the job entry wage rate, without an attempt to determine the longitudinal effects of vocational education. At the other extreme, at least one study collected historical data on labor market experience of graduates over a six-year period, but in the process encountered two rather serious methodological difficulties. One difficulty resulting from this extended follow-up period pertained to the problem of procuring a sufficient rate of questionnaire returns. This problem was attributable to hardships in locating respondents. The other difficulty related to the validity of the collected data. Increased periods of time tended to decrease the accuracy with which a respondent was able to recall specific earning and employment information.

A second problem in data collection concerned the adequacy of instruments used to obtain student follow-up data. Generally those studies using poorly designed questionnaires were associated with low rates of return. Also, the extent to which methods of strict random sampling could be used for purposes of improving the quality of the data and reducing the cost of data collection had not been fully explored by most of the studies cited.

ANALYSIS OF THE COST-EFFECTIVENESS OF VOCATIONAL EDUCATION PROGRAMS IN THREE SELECTED CALIFORNIA COMMUNITY COLLEGES

This section summarizes a pilot study in the area of cost-effectiveness analysis of vocational education programs. Unlike other studies conducted in the area which concerned themselves with determining whether vocational education is worthwhile, this study focuses on the needs of the local administrator relative to improving programs and resource allocation. Although the methods illustrated in this study are generalizable, the findings and conclusions pertain solely to the three colleges in the sample.

Design of the Study

The Problem. The main thesis of this study was that there exists considerable variation in the costs and accomplishments of vocational education programs at the community college level, but that through cost-effectiveness analysis the administrator can attain improved effectiveness and efficiency. From this general thesis, two crucial questions came to the foreground for analysis.

1. What is the incremental cost of training a graduate in the different vocational education programs in the three community colleges and how does knowledge of this cost, and its components, aid the administrator in attaining greater efficiency in resource allocation?

2. How effective are the different vocational education programs in the three community colleges and how does information on program effectiveness assist the administrator to identify weaknesses that must be overcome by policy changes?

Overview of Design. The term "social cost" was defined to allow for more meaningful discussion of the total costs of training graduates in different vocational and general education programs. The components of social costs indentified include:

(1) current costs, (2) capital costs of instructional equipment, (3) job-search costs, (4) foregone earnings, (5) incidental costs to students, and (6) costs of on-the-job training. The first two components represented expenditures incurred by different levels of government in training students, and their measurement was possible through the analysis of data available in each of the community colleges. The remaining four components represent opportunity costs foregone by the graduate as a result of his participation in one training program versus another. Of these costs, job-search and on-the-job training were estimated from labor market experience information obtained through a survey of graduates two years after leaving college. The marginal cost of the two remaining components were assumed to be negligible for the purpose of this study, insofar as they were believed to be roughly the same for graduates completing majors in either the general education or the vocational education program. Both types of students earned the same number of semester units before graduation.

The effectiveness of the various vocational education programs was judged in terms of the central objective identified in the California State Plan for Vocational Education: ". . . preparation of students for job entry and gainful employment." The gross hourly earning rate and the unemployment rate were two indices used to gauge the effectiveness of vocational education programs in terms of this goal. The gross hourly rate was defined as total earnings received divided by the number of hours worked. It was used as an index for measuring the relative degree to which graduates of various vocational programs were "gainfully" employed during the first two years after leaving community college. The unemployment rate (defined as the percent of total time a graduate who was available for employment spent in job-search or other nonvoluntary unemployment) served as a means of gauging the relative time spent by graduates of different vocational programs in finding jobs. After determining the gross hourly earning rate and the unemployment rate, this study estimated the magnitude of foregone earnings per graduate for training in a vocational education program vis-a-vis the general education program.

Three community colleges located in Los Angeles County, and selected in accordance with predetermined criteria, represented the community college population for this study. Data on current and capital costs of instructional equipment were obtained for both vocational and general education programs. For purposes of this study, the general education program included all other instructional programs – specifically, those exclusive of seven vocational education programs. Follow-up data for measuring program effectiveness were based on stratified samples of graduates drawn from the different major programs in each of the three community colleges.

Data Collection and Analysis

Cost data. The procedures used to collect and analyze data on the current operating costs of vocational education programs were the same as those described

TABLE 4-1 Calculation of Average Cost Per Contact Hour of Instruction for Indicated Programs in Community College (A), Using FY 1969-70 Data, In Dollars

Expenditure Object / Program	Distributive	Office	Health	Technical	T & I	General	Total
Direct Costs							
Directors' Salaries	$ 782	$ 1,420	$ 513	$ 280	$ 1,284	$	$
Supervisors' Salaries	7,218	25,005	11,621	4,920	14,759		
Teachers' Salaries	183,529	328,630	227,877	71,368	334,891		
Secretarial Salaries	1,249	2,266	819	447	2,049		
Other Certified Salaries	2,174	7,878	13,687	6,597	25,871		
Textbooks		754	71	754			
Supplies	1,049	3,812	11,988	3,638	13,992		
Other Direct Expenditures	127	45,571	1,317	1,300	5,151		
Total Direct Costs	196,128	415,336	267,869	89,804	397,997	3,628,405	4,995,539
Indirect Costs							
General Support	45,994	97,373	62,789	21,058	93,302	566,357	886,873
Instructional Support	1,178	2,494	1,608	539	2,390	16,465	24,674
Plant Oper. & Maintenance	53,986	114,298	73,700	24,717	109,515	475,138	851,349
Other Costs							
Capital Cost of Equipment		24,992	10,789	13,891	23,517	50,848	124,037
Total Annual Cost	297,286	654,488	416,755	150,009	626,721	4,737,213	6,882,472
Total Ann'l. Con.Hrs.	(642,636)	(1,166,194)	(421,184)	(230,212)	(1,054,752)	(7,050,954)	(10,565,932)
Cost per Contact Hr.	.46	.56	.99	.65	.59	.67	.65

in Chapter II of this report. For the purposes of the cost-effectiveness analysis, however, two extensions of this method had to be made. First, there was need to determine the cost of vocational education attributable to instructional equipment. The capital cost of instructional equipment was estimated by application of the capital recovery formula, which determines the average ". . . end of year annual amount over the life of the project necessary to pay interest on and recover the capital cost in full."[35] Tables 4-1, 4-2, and 4-3 show the cost per contact hour for the current and capital costs in the three colleges.

Second, there was need to express a different unit cost for vocational education, namely, the cost of training a graduate with a major in a vocational education program. This cost was calculated as a product of three factors: (1) credit units completed by the graduate, (2) contact hours per credit unit, and (3) cost per contact hour. The total cost of training a graduate in vocational education represented the sum of the costs associated with credits earned by each of the vocational education and general education courses. Table 4-4 illustrates the development of this unit cost.

Effectiveness data. Effectiveness data for this study were obtained from two sources: (1) official student records available through the Deans of Admissions and Records; and (2) Follow-Up Survey of Community College Graduates (FUSCCG), a mail questionnaire specifically developed for the needs of this study. A copy of FUSCCG is illustrated on the facing page.

Samples of community college graduates, stratified on the basis of the study program completed, were selected in each of the three colleges. Questionnaires were mailed to them approximately two years following their graduation in June 1969. In addition to the questionnaire, two reminder letters (and telephone calls to persons who could be reached) were required to secure the 80.8 percent return obtained. Of the 19.2 percent of the graduates who did not respond, about half had moved without leaving a forwarding address.

Follow-up data collected in the study were adapted for electronic data processing. Stepwise multivariate linear regression analysis was used to determine the effect of vocational education on the gross hourly earning rate and the unemployment rate of terminal graduates, holding constant the variables of sex, age, cumulative GPA, ethnic origin, and father's education level. A formula was developed also to estimate the social-economic benefit – the collective benefit to society and the individual graduate for taking his training in a vocational education program as opposed to a general education program. This estimate was derived from the gross hourly earning rate and the unemployment rate obtained.

Findings

The findings reported in this subsection pertain strictly to the three

FOLLOW-UP SURVEY OF COMMUNITY COLLEGE GRADUATES

Do NOT write your name on this questionnaire. Your responses will be kept confidential and anonymous. Respond to the questions below as accurately as you can.

1. If, during some period(s) of time from June, 1969 to the present, you were not working, was it because of:

☐ Continuation of your education or training?
☐ No job opening?
☐ Military service? Was your assignment related to your college training? ☐ Yes ☐ No.
☐ Other? (indicate) ________________

2. What gross earnings (before deducting taxes, insurance, etc.) do you expect to make three years from now? $________ per year.

3. Have you continued your education or training since you left college in June, 1969?

NO ☐ YES ☐ **Answer 4, 5, and 6 before going to 7.**

4. Where was this educational or training program taken?

☐ Community College
☐ 4-year College or University
☐ Trade or Vocational School
☐ Industry training
☐ Private Vocational School
☐ Other (indicate) ________________

5. Approximately how many hours per week did you spend in this program? ________ hours.

6. When did you start and leave this program? **Start:** Month ________ **Year** ________

Leave: Month ________ **Year** ________

7. How many years of schooling did your father complete? ________ years.

8. Check your ethnic background: ☐ Spanish American, ☐ Mexican American, ☐ Caucasian (other white), ☐ Afro-American, ☐ Oriental American, ☐ American Indian, ☐ Filipino American, ☐ Other ________________.

9. Have you held a full-time civilian job for one month or more at any time since you left college in June, 1969?

NO ☐ YES ☐ **Answer 10, 11, 12, and 13.**

Column #1 relates to the first job you had after leaving college in 1969.
Column #2 relates to the second job you had after leaving college in 1969 (answer only if you left first job to take second job).

		FIRST JOB AFTER COLLEGE	SECOND JOB AFTER COLLEGE
10. When did you start and leave this job?	**Start**	________ mo/day/year	________ mo/day/year
	Leave	________ mo/day/year	________ mo/day/year
11. How closely did this job relate to your college training?	Highly related	☐	☐
	Somewhat related	☐	☐
	Completely unrelated	☐	☐
12. What are (were) your gross earnings (before deducting taxes, insurance, etc.) on this job?		$________ wk/mo/yr (circle one)	$________ wk/mo/yr (circle one)
13. How many hours per week, on the average, do (did) you work on this job?		______ hours	______ hours

THANK YOU for your cooperation!

TABLE 4-2 Calculation of Average Cost Per Contact Hour of Instructions for Indicated Programs in Community College (B), Using FY 1969-70 Data, in Dollars

Expenditure Object / Program	Distributive	Office	Health	Technical	T & I	General	Total
Direct Costs							
Directors' Salaries	$ 2,196	$ 4,259	$ 2,680	$ 3,760	$ 3,618	$	$
Supervisors' Salaries	900	1,746	16,224	10,171	1,483		
Teachers' Salaries	23,435	44,166	170,124	161,490	121,970		
Secretarial Salaries	4,208	7,865	7,319	12,055	10,540		
Other Certified Salaries	2,810	5,450	3,430	4,812	4,630		
Textbooks	541	564	1,958	3,649	581		
Supplies	2,028	2,410	8,779	19,509	15,898		
Other Direct Expenditures	541	5,103	650	970	917		
Total Direct Costs	36,609	71,563	211,164	216,416	159,637	2,485,307	3,180,696
Indirect Costs							
General Support	6,198	12,125	35,784	36,668	27,053	312,202	430,030
Instructional Support	701	1,372	4,050	4,150	3,062	39,063	52,398
Plant Oper. & Maintenance	12,285	24,034	70,934	72,685	53,626	314,709	548,273
Other Costs							
Capital Cost of Equipment		19,125	5,518	26,140	58,064	82,196	191,043
Total Annual Cost	55,798	128,219	327,450	356,059	301,442	3,233,477	4,402,440
Total Ann'l. Con.Hrs.	(36,609)	(71,563)	(211,164)	(216,416)	(159,637)	(2,839,186)	(3,808,193)
Cost per Contact Hr.	1.52	1.79	1.55	1.65	1.89	1.14	1.16

TABLE 4-3 Calculation of Average Cost Per Contact Hour of Instruction for Indicated Programs in Community College (C), using FY 1969-70 Data, in Dollars

Expenditure Object / Program	Agriculture	Distributive	Office	Health	Technical	General	Total
Direct Costs							
Directors' Salaries	$ 921	$ 299	$ 2,592	$ 214	$ 1,733	$	$
Supervisors' Salaries	17,936	5,829	50,445	4,159	33,731		
Teachers' Salaries	190,588	61,940	536,026	44,192	358,422		
Secretarial Salaries	55,179	17,933	155,192	12,795	103,772		
Other Certified Salaries	15,456	5,023	43,471	3,584	29,068		
Textbooks							
Supplies	26,491	8,609	74,505	6,142	49,819		
Other Direct Expenditures	28	9	78	6	52		
Total Direct Costs	306,599	99,642	862,309	71,092	576,597	4,702,135	6,618,374
Indirect Costs							
General Support	31,134	10,119	87,565	7,219	58,552	1,333,390	1,527,979
Instructional Support	1,870	608	5,259	434	3,516	41,148	52,835
Plant Oper. & Maintenance	71,733	23,313	201,748	16,633	134,902	886,381	1,334,710
Other Costs							
Capital Cost of Equipment	7,332		10,426		63,834	56,000	137,592
Total Annual Cost	418,668	133,682	1,167,307	95,378	837,401	7,019,054	9,671,490
Total Ann'l. Con.Hrs.	(196,763)	(64,039)	(548,028)	(45,815)	(368,272)	(4,296,466)	(5,519,383)
Cost per Contact Hr.	2.13	2.09	2.13	2.08	2.27	1.63	1.75

TABLE 4-4 Estimated Average and Incremental Cost of Training a Community College Graduate Completing a Four-Semester Degree Program, for Community Colleges, A, B, & C, by Program

Program	Transcript Units			Semester Contact Hours		Average Cost per Graduate[1]			Incremental
	Total	Vocational	General	Vocational	General	Vocational	General	Total	Cost
General Education	68	--	68	----	1514	$----	$1741	$1741	$----
Agriculture	70	42	28	1064	709	1585	815	2400	659
Office	69	44	25	875	557	1304	641	1945	204
Distributive	69	44	25	875	557	1190	641	1831	90
Health	72	40	32	1489	713	2293	820	3113	1372
Technical	72	42	30	1107	668	1683	768	2451	710
Trade & Industry	72	42	30	1064	668	1681	768	2449	708

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[1] Calculated on the basis of Formula (5), assuming (a) values of parameters identified in source data, and (b) an average semester of study is of 17 weeks duration, where Formula 5 represents:

Cost of training a graduate = Semester units completed by graduate x Contact hours per semester unit x Cost per contact hour community colleges in the sample (designated as Colleges A, B, and C) and are not generalizable. They are presented here in considerable detail to illustrate a cost-effectiveness analysis technique which focuses exclusively on evaluating institutional programs.

Program costs. Although the final analysis of the cost data concerned the determination of the incremental cost of training community college graduates in different vocational programs, several findings appeared in the supportive analysis that warrant mention here. Table 4-5 illustrates a detailed development of these findings, some of the more important of which are listed below:

1. The direct costs of instruction, of which approximately 92 percent is attributable to faculty salaries, accounted for 60 to 77 percent of total current costs of instruction for the different programs within the three colleges.

2. The cost expended by different colleges in faculty salaries is subject to great variation. For the faculty salary category, College C in this study incurred roughly 100 percent more in vocational programs and 400 percent more in general education programs than College A. In actual dollar amounts, measured in terms of the Student Contact Hour, College C spent $.58 more in vocational programs and $1.04 more in general education programs than College A.

3. The support costs attributable to Plant Operation and Maintenance represent the second largest component of the total cost of instruction for both vocational and general education programs. This support cost represented between 10 and 20 percent of the total cost of instruction for programs within the colleges of this study.

4. The costs attributable to Plant Operation and Maintenance were roughly twice as great for vocational education programs in each of the three colleges as for the corresponding general education program. This high cost for vocational education is associated with the larger instructional area per student station in vocational education than in general education.

5. The capital cost of instructional equipment, which accounts for between 3 and 9 percent of the total costs of instruction for the different programs within the three colleges, was between three and seven times greater for vocational education than for general education. This indicates that vocational education programs at the three community colleges were more "capital intense" than general education programs.

TABLE 4-5 Breakdown of Cost Per Student Contact Hour of Instruction for Expenditure Category by College and Program Grouping, in Dollars

Expenditure Category	College A				College B				College C			
	General		Vocational		General		Vocational		General		Vocational	
	$	%	$	%	$	%	$	%	$	%	$	%
Direct Costs of Instruction	.51	(76)[a]	.39	(64)	.88	(77)	.72	(60)	1.09	(67)	1.56	(72)
Indirect Cost of Instruction												
General Support	.08	(13)	.09	(16)	.11	(10)	.12	(11)	.32	(20)	.16	(8)
Instructional Support	.00	(0)	.00	(0)	.01	(1)	.01	(1)	.01	(1)	.01	(0)
Plant Oper. & Maintenance	.07	(10)	.11	(18)	.11	(10)	.24	(20)	.20	(12)	.37	(17)
Other Costs												
Capital Cost Equip.	.01	(2)	.02	(3)	.03	(3)	.11	(9)	.01	(1)	.07	(3)
Cost Per Contact Hr. (Total)	.67	(101)[b]	.61	(101)[b]	1.14	(101)[b]	1.20	(101)[b]	1.63	(101)[b]	2.17	(100)

Source: Tables 4-1, 4-2, & 4-3 for Colleges A, B, and C, respectively.

a. Represents a percent of total cost per student contact hour for program within college.

b. Do not add up to 100 percent because of rounding error.

6. Finally, this study found that in general the cost of training a vocational education graduate was greater than that of a general education graduate. The incremental costs (the additional costs required to train a graduate with a vocational rather than a general education major) were estimated to be of the following magnitude: Agriculture, $659; Office, $204; Distributive, $90; Health, $1,372; Technical, $710; and Trade and Industry, $708. Table 4-4 illustrates the detailed development of these costs.

Higher costs of training vocational education graduates were attributable to at least two factors. First, the annual current cost and capital cost of instructional equipment tended to be greater per Student Contact Hour for vocational than for general education programs. Two elements within this factor tended to effect an increase in the unit cost for vocational education: (a) the slightly higher expenditure incurred by the factors described in points 1 through 6 above; and (b) the lower enrollment in vocational education courses. Clearly, low enrollments tend to reduce the total number of Student Contact Hours generated by a program. This has the effect of increasing the average unit cost, since the "setup" costs remain largely the same for high activity as for low activity programs.

Second, the higher cost of training vocational education graduates is attributable to the greater number of Student Contact Hours required as opposed to those for a general education graduate. Although all graduates were required to complete about 64 credits, the actual hours of instructional contact experienced by graduates of different vocational education programs varied considerably. Increased instructional contact results from the type of curricular activities carried out in vocational education. In particular, vocational education students spend more time in shop and laboratory activities than general education students. On the average, for every student credit hour earned, the number of student contact hours of service provided in the three colleges was as follows: General Education, 1.3; Agriculture, 1.5; Distributive, 1.2; Office, 1.2; Health, 2.2; Technical, 1.6; and Trade and Industry, 1.5. From these findings it is evident, for example, that each credit hour earned by a student in the Health program required about two-thirds (or .9 hours) more instructional classroom contact than that required for a credit hour in general education. The direct and support costs associated with this additional service for certain vocational programs account, in part, for their higher cost.

Large variations in the magnitude of the incremental cost were readily explained in terms of the two factors identified above. A program in which both the unit cost and the instructional contact are high produced a large incremental cost (e.g., Health, $1,372). Conversely, programs with low unit costs and low instructional contact generated negligible incremental costs (e.g., Office, $90).

Program Effectiveness. After it had been determined that the central objective of vocational education programs was "to prepare students for job entry and gainful employment," the effectiveness of different programs was measured in terms of two indicators: (a) gross hourly earning rate was utilized to gauge the extent to which vocational programs prepared graduates for "gainful" employment; and (b) unemployment rate was used to measure the degree to which vocational programs prepared graduates for job entry.

Earning rate. The findings relating to the gross hourly earning rate are listed below. A more detailed development of these findings is found in Table 4-6.

1. There was no evidence in this study to indicate that terminal graduates of the Unrelated Vocational and the Health programs experienced, on net (i.e., holding constant the effects of sex, age, cumulative GPA, ethnic origin, and father's level of education), higher earning rates during the first two years after graduation than did general education graduates. The actual gross hourly earnings experienced by terminal graduates of these two programs showed wide variation and were not significantly different from those experienced by the general education graduate.

2. During the first year after graduation, the terminal Office graduate grossed $.37 per hour more and the terminal Trade & Industry, Technical graduate grossed $.51 per hour more, on net, than did the terminal general education graduate.

3. During the second year after graduation, the terminal Office graduate grossed $.41 per hour more and the terminal Trade & Industry, Technical graduate grossed $.49 per hour more, on net, than did the terminal general education graduate.

4. During the fifth year after graduation, terminal Office, Trade & Industry, and Technical graduates maintained, roughly, the same advantage in the gross hourly earning rate over the terminal general education graduate. This latter finding, however, is not statistically significant.

Unemployment rate. The degree to which vocational education programs prepared graduates for job entry, as measured by the second indicator, varied considerably for programs in the three community colleges. Some of the more important findings, which are extracted from Table 4-7, are listed below.

1. There is no evidence in this study to indicate that terminal graduates of the Unrelated Vocational and the Health programs in the three colleges experienced, on net, a lower unemployment rate during the first two years after graduation than did general education graduates. The lack of statistically significant differences in the unemployment rates for these

TABLE 4-6 Estimated Gross Hourly Earning Rate of Terminal Community College Graduates, Colleges A, B, & C, in Dollars

Variable	First Year After Graduation		Second Year After Graduation		Five Years After Graduation	
	b	(s)	b	(s)	b	(s)
Occupation						
General Education@						
Unrelated Vocational[1]	-.10	(.21)	-.04	(.25)	.09	(.37)
Office	.37*	(.19)	.41*	(.22)	.37	(.43)
Health	.19	(.97)	.18	(.88)	-.11	(1.14)
T & I Technical	.51*	(.26)	.49*	(.27)	.67	(.74)
Female	-.85**	(.26)	-.89**	(.26)	-1.11*	(1.02)
Age	.05**	(.02)	.04*	(.02)	.04	(.03)
Cumulative GPA	.44*	(.24)	.14	(.25)	.37	(.39)
Non-Caucasian	-.10	(.11)	.05	(.12)	-.20	(.19)
Father's Education	.02	(.12)				
Number of Observations	112		112		112	
Coefficient of Determination	.43		.41		.40	
Intercept	1.15		2.41		2.49	
Standard Error of Estimate	1.12		1.10		1.33	
Mean of Dependent Variable	3.60	(1.44)	3.71	(1.38)	5.07	(2.15)
F - Ratio:						
All Variables	9.86**		8.87**		8.65**	
Occupation	4.42*		4.11*		2.91	

Notes:

* Significant at the .05 level.

** Significant at the .01 level.

b is the partial regression coefficient.

(s) is the standard error of the partial regression coefficient.

@ This regressor of the variable enters into the intercept term. The other dummy regressors of the variable are interpreted as deviation from this regressor.

1 Includes those graduates who completed a vocational education major of study and accepted employment in an area unrelated to training.

TABLE 4-7 Unemployment Rates of Terminal Community Graduates for Indicated Period, Colleges A, B, & C, in Percents

Variable	First Year After Graduation		Second Year After Graduation	
	b	(s)	b	(s)
Occupation				
General Education@				
Unrelated Vocational[1]	1.2	(5.6)	1.4	(6.2)
Office	-7.0*	(3.1)	-6.8*	(2.9)
Health	-3.9	(3.6)	-5.1	(6.1)
T & I Technical	-6.2*	(2.9)	-5.5	(4.2)
Female	.5	(4.7)	1.9	(6.2)
Age	-.3	(.3)	-.2	(.4)
Cumulative GPA	-.7	(4.4)	1.2	(5.9)
Non-Caucasian	-1.3	(2.1)	1.5	(2.8)
Father's Education	2.7	(2.3)	1.0	(3.0)
Number of Observations	112		112	
Coefficient of Determination	0.26*		0.24	
Intercept	20.4		17.4	
Standard Error of Estimate	12.0		18.0	
Mean of Dependent Variable	11.4	(12.2)	9.4	(17.2)
F - Ratio:				
All Variables	3.811*		3.571	
Occupation	8.098**		5.792**	

Notes:

* Significant at the .05 level.

** Significant at the .01 level.

b is the partial regression coefficient.

(s) is the standard error of the partial regression coefficient.

@ This regressor of the variable enters into the intercept term. The other dummy regressors of the variable are interpreted as deviation from this regressor.

[1] Includes those graduates who completed a vocational education major of study and accepted employment in an area unrelated to training.

two groups of graduates and the general education graduates indicates that the vocational training received had no more effect on reducing the job-search period for these graduates than for the general education graduates in the three colleges studied.

2. During the first year after graduation, the terminal Office graduates were unemployed 7.0 percent and the terminal Trade & Industry, Technical graduates were unemployed 6.2 percent points less, on net, than terminal general education graduates. That is, terminal Office and Trade & Industry, Technical graduates were employed for 3.6 and 3.2 weeks more, respectively, during the first year after graduation than general education graduates.

3. During the second year after graduation, the terminal Office graduates were unemployed 6.8 percent and the Trade & Industry, Technical graduates were unemployed 5.5 percent points less, on net, than terminal general education graduates. Expressed differently, terminal Office and Trade & Industry, Technical graduates were employed, on net, 3.5 and 2.9 weeks more, respectively, than terminal general education graduates.

4. The final analysis of the effectiveness data in this study concerned the estimation of the social-economic benefit per terminal graduate for receiving training in a vocational as opposed to a general education program. This analysis was limited entirely to those three vocational programs that showed statistically significant differences in earning and unemployment rates.

The study estimated that terminal graduates of the Office, Trade & Industry, and Technical programs earned, on the average, about $1,300 per year more than did terminal general education graduates. The social-economic benefit was attributable to two factors. First, the terminal vocational graduate was employed for about 16 days more per year, on the average, than the terminal general education graduate. The opportunity cost incurred by general education graduates because of delayed job entry was estimated to be about $400 per year (i.e., 25 hours x $4.13 per hour). Second, the opportunity cost attributable to lower gross hourly earnings experienced by a general education graduate was about 44 cents per hour or approximately $915 per year (i.e., 1080 hours x $.44 per hour). Reduced earnings on the part of general education graduates were believed to be a reflection of lower productivity and higher in-service training costs resulting from hiring a general education graduate.

Conclusions Derived from Study

Evaluating Program Effectiveness. The starting point for interpreting the findings of this study was to identify those programs that were characterized by a low level of effectiveness. One such program was Health in College A of this study. These graduates, when compared with those of the general education program, experienced neither high hourly earnings, nor shorter periods of unemployment. In other words, vocational training in the Health program had no more effect on job entry and gainful employment than the absence of this training. This finding has spotlighted a possible weakness which the community college administrator must evaluate from a broader context. The administrator first needs to investigate whether the specific Health program in College A is training graduates in occupational specialties that are characterized by insufficient job openings to accommodate the supply from College A and neighboring institutions in the employment area. The long period of job-search experienced by this group of graduates during the first two years after college indicates that difficulty was experienced in locating jobs related to their training. The low hourly earnings of these graduates may indicate that supply exceeds demand for graduates possessing the skills characteristic of the particular Health program graduates in College A. To determine whether their lack of success was attributable to either of the above factors, the administrator should further study data on manpower needs available through the local or regional human resources agency.

The administrator needs to investigate further whether the instruction provided in the specific Health program in College A is adequate. Skills desired by employers may not have been mastered; consequently, the high unemployment may reflect employer unwillingness to hire graduates of this program. For the same reason, graduates of this program may be at a disadvantage when forced to compete for jobs with those trained in other vocational-technical institutions. The low hourly earnings experienced by these Health graduates may also reflect a reduction in earnings to compensate for cost of on-the-job training provided by the employer. To resolve this situation, the community college administrators should work more closely with employers in planning programs and developing performance standards that are consistent with the needs of employers. To ensure that these standards are maintained, the employer and college administrator can further cooperate in developing standardized examinations that can be administered to students upon completing their program.

Finally, the administrator needs to determine whether the Health program in College A, although failing to reduce unemployment or to increase earnings of its graduates, is still meeting important needs of the student and the community which justify its continued existence. If it can be determined that proper skills are being taught in the program, then the unfavorable labor market experience of graduates may merely be a reflection of either high student demand for entering training in that Health occupation, or society's lag in the recognition of need for it. Attempts by the administrator to bring student preferences in line with employment opportunities may be achieved, to a degree, through occupational counseling. Society's failure in the past to recognize the importance of improving health services was largely outside the control of the administrator. In either case, the administrator had little choice but to continue allocating some resources to that program. After evaluating all of the vocational programs in the college, however, the administrator may then decide to assign a lower priority to that Health program in terms of resource allocation. Another alternative available to the administrator is to introduce measures to reduce the high cost of the program while accommodating basic student preference. This alternative will be discussed in greater detail later in this chapter.

Unrelated vocational program. A second program characterized by a low level of effectiveness is the Unrelated Vocational. This grouping, comprised of graduates from the different vocational programs who obtained jobs completely unrelated to their major program of study, experienced lower hourly earnings and higher unemployment than general education graduates.

The long unemployment period and low earnings experienced by graduates in this group, in addition to spotlighting some of the weaknesses identified for the Health program, suggest that vocational graduates have difficulty in transferring skills to occupations other than those for which they are specifically trained. To ensure that all graduates are able to utilize their training to the fullest, the administrator should make every effort to see that the vocational graduates are placed in jobs related to their training. One means to this end is to shift resources to the placement program. Such action may enable community colleges to improve attainment of the overall objectives of their vocational education programs.

Finally, the administrator should note that the Office, Trade & Industry, and Technical programs within each of the respective colleges successfully attained their objectives. Graduates of these programs experienced less difficulty in locating jobs related to their training, and grossed more per hour than did general education graduates. This finding indicates to the administrator that the additional resources expended in the Office, Trade & Industry, and Technical programs yielded a positive benefit. The magnitude of this benefit was estimated to be roughly $1,300 per graduate for each of the first two years after leaving college. Of course, there are other material and intangible benefits enjoyed collectively by the individual and the community that could not be measured, and therefore were not included in this estimate. In any event, the added investment in these vocational education programs was justified by the positive benefit realized.

Although the Office, Trade & Industry, and Technical programs of the three colleges rated highly on the scale of effectiveness, the administrator should NOT neglect the future evaluation of these programs. Over-expansion of these programs through high priority resource allocation may cause them to be victims of some of the same factors that affect the Health program at College A; i.e., the expansion of those programs to the extent that the output of graduates does not correlate to manpower needs may shortly make them ineffective. To safeguard against this occurrence, the administrator should continuously review present and future manpower needs, and balance these needs with the outputs of all the vocational-technical institutions in the region.

Evaluating Program Costs

The evaluation of program costs, which should be conducted concurrently with the evaluation of program effectiveness, assists the administrator to identify different means for attaining greater efficiency in the allocation of resources. By comparing components of program costs, the administrator is able to spotlight inconsistencies. This in turn helps the administrator to identify those weaknesses in organizational structure that cause unnecessary increases in total costs and efficiency of instruction. This methodology should be viewed as a means for increasing opportunities for students, faculty and the community, as well as improving the quality of other programs in the college curriculum.

Reducing cost variations among colleges. Even though there was no evidence in this study to indicate that Colleges B and C operated educational programs that were more effective than those of College A, the cost findings clearly showed that the unit cost of instruction in these colleges was considerably higher than that for College A.* The immediate question an administrator should entertain is: What changes should be effected in the operational structure of Colleges B and C to reduce the overall costs of instruction to that of College A? There may be a number of answers to this question, but only those that are realistic can be considered.

Among the more important findings of this study was the one showing that the unit cost of instruction decreased with increases in average class enrollment. One of the factors used to explain the lower unit instructional cost in College A, for example, was the higher average class size as compared to Colleges B and C. This factor, as simple as it may appear, provides the administrator with one of the most direct methods of reducing the high cost of certain programs. Therefore, a reduction in overall program costs in Colleges B and C can be achieved by increasing the average class size of all courses in these colleges. One means of increasing average class size is to eliminate those courses which, for one reason or another, demonstrate low activity as measured in terms of enrollment, or number of Student Contact Hours. Before the administrator attempts to eliminate low activity courses, however, certain minimal class size standards need to be developed. These standards should not be based solely on cost considerations, but must account for differences attributable to the nature of the learning activity, mode of instruction, and student needs. Factors which could justify exception to the minimal class size standard:

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*The Health program in College A may be an exception to this statement. Because Colleges B and C did not operate a Health program, it is not intended that this program be included when making comparisons among colleges.

a. The cancellation of the course delays the graduation of those students enrolled.

b. The course is required to maintain the proper sequence of courses in a major.

c. The students or instructor cannot be reassigned to another section.

d. The course cannot be offered at a later semester without disrupting student schedules.

A second method of reducing overall unit costs of instruction at the college level is by decreasing the salary cost component of instruction. Since salary costs comprise the largest single component of the unit cost of instruction, a decrease in salary expenditures effects a considerable overall decrease in total instructional costs. By using extended-day scheduling, College A not only made better utilization of facilities possible, but was also able to hire instructional staff at a lower cost. Salary savings were realized on the extended-day schedule because part-time faculty were hired at a rate of pay roughly equivalent to one-third that of regular full-time faculty. Other advantages that result from the extended-day program:

1. The extended-day schedule makes educational services more accessible to those members of the community who hold full-time jobs during normal working hours.

2. The extended-day schedule promotes better utilization of instructional facilities and equipment.

3. The extended-day schedule provides greater opportunity for the recruitment of faculty in business with first-hand experience and industry; consequently, this makes classroom vocational-technical training more relevant to existing needs in the labor market.

It is evident from the above considerations that there are other than economic advantages for conducting extended-day programs. This possibility, if explored more fully by the administration of Colleges B and C, in addition to ensuring greater efficiency in operations, can benefit the community through tax savings, and can also afford a wider range of opportunity for the student.

Reducing cost variations among programs. The findings of this study indicate that a large part of the incremental cost of training vocational education graduates can be attributed to the high cost of Plant Operations and Maintenance, and of Instructional Equipment. Costs attributable to Plant Operations and Maintenance were charged against programs in proportion to assignable instructional square footage, while Instructional Equipment costs were based on initial acquisition costs.

It follows, therefore, that the cost attributable to these two items represents a fixed charge, in the form of a setup cost, on which low or high levels of utilization have little effect. Because the operating cost of a program decreases with increased levels of utilization, however, it is important that programs be operated at capacity for maximum use of educational resources. Some high-cost programs are merely a reflection of underutilization and can be brought in line through the following changes aimed at improving the use of facilities and equipment.

1. Increasing the number of assignable student stations in the instructional facility.

2. Increasing the level of occupancy of the assignable stations in the instructional facility during any one scheduled period.

3. Increasing the number of hours during which scheduled learning activities are conducted in the facility.

Strict application of utilization standards in some instances may result in serious reductions in the scope of the curriculum of the college. Courses which would not generate sufficient enrollment would tend to be dropped from the college schedule. Eventually, the choice available to students in courses and programs offered might be greatly limited.

One method of compensating for reduced curricular offering in a college is through joint sharing of facilities at the interdepartmental and/or the intercollegiate levels. Departments within a college can cooperate in the joint use of existing space and equipment so that maximum utilization is assured. Similarly, neighboring colleges, especially those within commuting distance, can make arrangements whereby certain low preference programs can be offered at the intercampus level through pooling of students. Besides reducing costs, which is a benefit to the community, this approach increases the scope of curricula available to the student.

Incremental cost for pricing and resource allocation. A final finding of this study indicated that while all community college students had earned the same number of credits by the time of graduation, the total number of hours of instructional contact accumulated by graduates of certain vocational programs tended to be greater than that received by general education graduates. Usually, those vocational programs which relied heavily on laboratory and shop-related instruction were associated with a greater number of hours of contact, and therefore showed higher incremental costs.

Knowledge of the ratio of instructional contact to instructional credit, when translated into incremental costs, provides the administrator with valuable data for decision-making. In particular, knowledge of the magnitude of the incremental costs can provide the administrator with a basis for pricing programs when preparing budget requisitions, as well as for allocating resources internally to gain effective use of available funds. Given a fixed amount of resources, more students can be served in a low-cost than in a high-cost program. The Health program in this study represents a case in point. It can be shown that the additional resources required to train one Health graduate at College A, when shifted to other programs, can train the following number of graduates: Agriculture, 2; Office, 7; Distributive, 15; Technical, 2; Trade & Industry, 2. On the basis of these figures, it is evident that from 2 to 15 students, depending on the program selected, can be trained with the resources required to train one Health graduate. Because the Health program at College A was found to be the least effective of those considered in this study, a shift of resources away from this particular program may present a more acceptable alternative in terms of institutional goals.

Application of the cost-effectiveness principle indicates to the administrator that program costs should be correlated with program benefits. Assuming that the administrator has made appropriate changes that result in efficient and effective program operations, high cost programs should be expected to attain higher level benefits, and lower cost programs vice-versa. Programs that do not meet this fundamental criterion should be carefully scrutinized by the administrator and modified accordingly. Before this standard can be met, the administrator must have complete knowledge of incremental program costs and benefits. The present study supported this need.

RECOMMENDATIONS

1. More effective use of follow-up studies should be made by local educational administrators in order to improve evaluation of current vocational education program accomplishments. For normal use of follow-up studies, it is recommended that educators employ the following practices and procedures:

a. Establish rapport with the student before he graduates. A school official may inform students of the importance of follow-up information for program planning, and solicit their cooperation. At this time, the school official may ask the student to complete a personal data sheet, on which the student records an address and telephone number for future correspondence or communication. After the student leaves the institution, this information can be updated from a carbon copy of the "Request for Verification of Academic Record" application. Requests made by students to have their academic records forwarded to employers provide one of the most up-to-date means of maintaining contact with students.

b. Regular follow-up surveys for all graduates should be conducted. If resources are insufficient to survey all graduates in any one year, it is recommended that sampling techniques be utilized. Such procedures are particularly useful when comparing a new program having only a few graduates with a well-established program that has many graduates. A sample of graduates of the large program establishes the comparison group for analysis. Follow-up of graduates should also be conducted on the same graduates at annual intervals to determine longitudinal effects of training on their labor market experience. Limiting follow-up data to initial placement disregards important information relating to time spent in job-search and non-voluntary unemployment.

c. The format and structure of the follow-up survey form should not be overlooked. It should give concise instructions and concern itself with the collection of data that are relevant, yet unavailable through other sources. If earning data can be obtained from a survey of employers, or from data available through state employment service agencies, they should not be requested from the graduate. The most important information collected should relate to (a) time spent in employment; (b) voluntary withdrawal from the labor force; and (c) non-voluntary unemployment.

d. The degree of statistical analysis conducted on follow-up data depends on the nature of the data and their intended use. If the sample size is large, simple cross-tabulation of the data will provide the necessary information for the purposes of the researcher. More elaborate cost-effectiveness analysis may require the researcher to conduct multivariate linear regression analysis in order to determine the effects of training on labor market experiences while controlling for the different graduate characteristics.

2. Regular evaluation through cost-effectiveness analysis should be made in order to provide the educational administrator with more information for measuring the strengths and weaknesses of the various instructional programs and their activities.

Cost-effectiveness analysis, as compared to cost-benefit analysis, incorporates the measurement of a considerably broader scope of objectives and accomplishments. With the recent programs in the determination of program costs, the feasibility of using cost-effectiveness analysis in education has increased. Moreover, because of recent developments in the area of program costing, analysts can concentrate on improving the techniques for measuring program effectiveness.

Various uses of cost-effectiveness analysis can be made at the district level. Large districts with more than one school, for example, could carry out regular cost-effectiveness analyses to determine the strengths and the weaknesses of the various programs within and among their member institutions. Such analyses can be particularly valuable to the central administrative office in planning specific programs for the different institutions of the district; i.e., each institution could be encouraged to specialize in those programs that it can offer with maximal relative effectiveness and efficiency (as compared to other institutions).

3. Cooperative agreements for facilities' sharing should be considered between and among (a) departments (programs) in each school, and (b) districts in the area in order to maintain or increase program offerings in school districts.

To afford students a wider range of curricular choice, without undue burden on available resources, there is need to increase enrollments to the point where utilization standards can be feasibly attained.

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CHAPTER V

FEDERAL ALLOTMENTS FOR VOCATIONAL EDUCATION

Paul S. Gilbert

CURRENT ALLOTMENT PRACTICES

The Federal government has been aiding vocational education directly with funds since 1917, when the Smith-Hughes Act was passed, as discussed earlier in this report. For the most part, this aid has been allotted to states on the basis of their respective populations.* Most moneys now appropriated are allotted to states under Section 103 of the Vocational Education Act of 1963, as amended, hereafter referred to as the Act.[1] For example, 89.5 percent of the fiscal year 1971 (FY 1971) vocational education appropriation was allotted according to Section 103. Table 5-1 shows the basis for allotting the FY 1971 appropriation, most of which is authorized by Parts B, C, and F of the Act to be used for: state vocational education programs, research and training in vocational education, and consumer and homemaking education.

Section 102 sets aside 10 percent of the moneys appropriated for Parts B, C, and F of the Act for research. The other 90 percent of the money is allotted according to Section 103, which allocates money to states on the basis of each state's proportion of the nation's population of specified age groups. This proportion is adjusted by a state per capita income ratio, but the adjustment is limited in scope, inasmuch as this ratio must be between .4 and .6 for all states. Each state's allotment is expressed in four parts which differ because they are based on various population age groups, arranged according to the age of its members in the fiscal year preceding the one for which the allotment is being calculated. The groupings used are: ages 15 to 19 inclusive, ages 20 to 24 inclusive, ages 25 to 65 inclusive, and ages 15 to 65 inclusive. The latter is widely inclusive because the last part of the apportionment is distributed in proportion to the amounts of money received by the states under the previous three parts of their allotment.

The population group between the ages of 15 and 19 has the greatest effect on the distribution of funds among states. This is because 50 percent of the money is distributed in proportion to this age group. Moreover, the 15 percent of the money that is allocated according to the distribution of the other 85 percent of the money is greatly influenced by the distribution of this age group. Thus, disregarding

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*U.S. Congress, Public Law 90-576: Vocational Education Amendments of 1968, October 16, 1968, Sec. 106, states that the term "State" includes in addition to the several States, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, and the Trust Territory of the Pacific Islands.

TABLE 5-1 Vocational Education Programs, FY 1971

Type of Program	Source of Allotment Procedures	FY '71 Appropriation	% of Appro.
	Based on population and per capita income		
Basic annual grant	Sec. 103	$315,302,400	70.8
Research	Sec. 102	35,749,745	8.0
Special needs student programs	Sec. 103	20,000,000	4.5
Department of Labor manpower studies	Sec. 103	----	0
Consumer and home-making education	Sec. 103, 161(2)(c) and (d)	21,250,000	4.8
Permanent grants to states	Smith-Hughes Voc. Ed. Act of 1917; Sec. 1-4 and Amend. to the Voc. Ed. Act of 1963, Sec. 104	6,445,310	1.4
Subtotal		$398,747,455	89.5
	Based partly on population		
Co-operative education	Sec. 172(b)(1)	$18,500,000	4.2
Exemplary programs and projects (innovation)	Sec. 142(b)	16,000,000	3.6
Work-study	Sec. 181(b)(1)	5,500,000	1.2
Subtotal		$40,000,000	9.0
	Based on other criteria		
Curriculum development	Sec. 191(c)(1)	$4,000,000	.9
State advisory councils	Sec. 102(c); 104(c)	2,380,000	.5
National Advisory Council	Sec. 104(c)(4)	330,000	.1
Subtotal		$6,710,000	1.5
Grand Total		$445,457,455	100.0

the minor effects of the state allotment ratios, 59 percent of the funding allotted according to Section 103 is distributed on the basis of the 15- to 19-year-old group.

Although Section 103 accounts for the lion's share of the appropriated funds, another 9 percent of the fiscal year 1971 appropriation was based on some type of population count. Thus, for "cooperative education," and in the case of "exemplary programs and projects," up to 3 percent of the appropriation is put aside for outlying territories. Then a flat grant of $200,000 is allotted to each state. The remaining amount is allotted according to ratios made by each state's population of those aged 15 to 19, inclusive, divided by the total corresponding population of the United States.[2] In addition, the work-study program allotment is based on the ratio made by the state's population, ages 15 to 20, inclusive, of the preceding fiscal year, to the sum of all "States'" corresponding populations.[3]

Only the curriculum development, National Advisory Council, and state advisory councils' moneys provided by the Act are not currently based in whole, or in part, on population data, and these three portions of the FY 1971 appropriation made up only 1.5 percent of the moneys for vocational education. Population in whole or in part thus determined the allocation of 98.5 percent of the FY 1971 vocational education appropriation.

The 1968 Amendments comprised the most detailed legislation regarding vocational education to date. The 1963 Act had required that one-third of the funds appropriated under Section 3 of the Act, the section controlling the vast majority of the moneys, be used for the construction of area vocational schools and post-secondary vocational education. But the 1968 Amendments required that, of the total funds allotted to states, at least 15 percent be used for the vocational education of persons with academic and socio-economic handicaps not due to physical causes. In addition, a minimum of 15 percent of the total funds must be used for post-secondary vocational education. Furthermore, 10 percent of the funds appropriated under Section 102(a), the section authorizing the majority of the funds, must be used for physically handicapped children. Thus, almost 40 percent of the moneys were restricted for certain types of students, and the more specific authorizations involving research, curriculum development, and exemplary programs specified certain types of vocational education efforts that must be pursued with Federal funds.

Whereas the 1963 Act set up state bodies to deal with vocational education state plans and evaluations, the 1968 Act went into detail as to the membership of the boards, and also set aside moneys to help these boards operate. State plans were much more detailed, and had to include a long-range program and an allotment priority system. This system had to consider the educational needs of all population groups, the relative ability of local education agencies to pay, the excess cost of programs, and the rates of unemployment in local areas.

Thus, although the allotment mechanism for the majority of the money did not change from 1963 to 1968, the use of separate authorizations for some money, the use of restrictive legislative language to encourage innovation, and more long-range planning make the 1968 Amendments unique in vocational education legislative history.

ALLOTMENT CONCEPTS

Distribution of Federal funds among states may be based on project approval, giving broad discretionary powers to Federal authorities, or based on an objective formula, under which the amount granted to a state is determined by statistical information. The latter method has been used extensively in the allocation of Federal funds for vocational education among states.

Four different types of statistical measures may be used for the distribution of Federal grants-in-aid among states. These are referred to as "allotment concepts" and are identified as measures of: (1) potential program load, (2) program accomplishments, (3) fiscal need, and (4) fiscal effort.

Potential program load is measured by the number of people who might benefit from a service. For most governmental services, the potential load will be all (or a major portion) of the population. For education, it could be a select group within the population, but their number will usually be highly correlated with the total population. However, there are exceptions, such as students needing English as a second language instruction. In the case of vocational education, a potential load measure for those in high school and college would be the number of those students who were not expected to complete a bachelor's degree. Still another measure would be the number of unemployed persons.

Program accomplishments are the outputs resulting from the program and/or changes made in individuals participating in the program. The final output of vocational education is the trained personnel who are placed in jobs where they can utilize their training. An intermediate accomplishment is the training of students, and indications of this would be the number of vocational education students and graduates, along with measures of the skills developed in the program.

Measures of program accomplishment need not correlate highly with program load measures. Communities with low financial capacity and/or willingness to spend money on vocational education might have many people who need vocational education, but few programs established to train potential students.

Fiscal need is measured by the amount of money required to operate a minimum level of services after a specific local fiscal effort has been made for these services. In theory, the fiscal effort required of state governments is a percent of its tax base, but in practice, the more available figure, personal income, is often used. The total cost of the minimum level of service can be found by multiplying the cost per unit of service by the number of service units.

In terms of vocational education, fiscal need is the cost to the Federal government of providing vocational education to students after a minimum percentage of state tax bases has been spent for vocational education. Using the fiscal need concept for vocational education only, however, ignores other fiscal needs of local educational agencies and states. An extremely wide fiscal need effort could be obtained by considering all state and local governmental services. This study compromises, and adopts a fiscal need criterion which covers educational needs, but does not attempt to cover other governmental needs.

Personal income is often used as the basis of fiscal capacity calculations because it is an available statistic. In theory, the ideal fiscal capacity measure for state and local governments' support of education would be a mixture of the bases of those taxes and fees used to support education. But regardless of the statistic which is used for fiscal capacity, as fiscal capacity increases the fiscal need decreases.

A dilemma found in this study and in previous studies is the conflict between the concepts of fiscal need and program accomplishment. Given the same propensity to spend on vocational education, richer states will tend to spend more dollars on vocational education. If this increased spending means that more vocational educational programs are financed and more graduates of these programs placed, then basing funding on program accomplishment measures would benefit richer states and hurt poorer states. Conversely, if allotments are based upon fiscal need, and this is measured by personal income per capita, then the poorer states will benefit even though they may not be doing much to promote vocational education.

Fiscal effort is the amount of financial resources a state spends on education in relation to its fiscal capacity. However, the expenditures of these governments on public education will vary inversely with the percentage of students enrolled in private schools. Efforts of citizens in supporting private schools permit a smaller fiscal effort of governments to support public education.

Measures for fiscal effort will increase directly with school expenditures. But many program accomplishment measures are dependent upon increased expenditures, and thus program accomplishment and fiscal effort measures will be directly related to each other. This is due to the fact that, as school expenditures increase, the amount of money spent on vocational education will probably also increase. If school expenditures increase because of a greater number of secondary and post-secondary students, then an increase in school expenditures will be accompanied by an increase in student load.

TABLE 5-2 Allowable Measures for Allotting Funds Among States*

State	Population	Weighted Population	Enroll-ment	Adjusted Population	Revised Population	Effort
(1)	(2)	(3)	(4)	(5)	(6)	(7)
ALABAMA	3444.	531.	870.	2066.	2097.	$ 86.
ALASKA	302.	47.	80.	125.	130.	10.
ARIZONA	1772.	271.	463.	961.	946.	61.
ARKANSAS	1923.	288.	476.	1154.	1183.	56.
CALIF.	19953.	3105.	5273.	8692.	8949.	596.
COLORADO	2207.	347.	593.	1133.	1127.	71.
CONNECT.	3032.	460.	774.	1213.	1227.	90.
DELAWARE	548.	84.	154.	246.	251.	18.
FLORIDA	6789.	991.	1558.	3636.	3588.	194.
GEORGIA	4590.	715.	1155.	2640.	2571.	137.
HAWAII	770.	122.	212.	325.	337.	24.
IDAHO	713.	110.	195.	418.	406.	25.
ILLINOIS	11114.	1690.	2894.	4734.	4898.	230.
INDIANA	5194.	797.	1356.	2690.	2671.	172.
IOWA	2825.	422.	770.	1496.	1480.	130.
KANSAS	2249.	344.	579.	1153.	1147.	65.
KENTUCKY	3219.	497.	798.	1931.	1886.	100.
LA.	3643.	561.	987.	2186.	2146.	138.
MAINE	994.	148.	272.	581.	564.	40.
MARYLAND	3922.	606.	1036.	1794.	1827.	136.
MASS.	5689.	862.	1412.	2526.	2590.	152.
MICHIGAN	8875.	1368.	2535.	4281.	4313.	353.
MINN.	3805.	572.	1077.	1950.	1940.	152.
MISS.	2217.	337.	615.	1330.	1413.	64.
MISSOURI	4677.	702.	1254.	2468.	2442.	148.
MONTANA	694.	107.	193.	395.	385.	32.
NEBRASKA	1484.	223.	389.	774.	768.	38.
NEVADA	489.	75.	128.	206.	213.	14.
NEW HAMP	738.	111.	186.	400.	394.	25.
NEW JER.	7168.	1083.	1771.	2965.	3085.	247.
NEW MEX.	1016.	156.	301.	610.	590.	42.
NEW YORK	18191.	2755.	4427.	7276.	7523.	734.
N. C.	5082.	815.	1238.	3004.	2911.	153.
N.D.	618.	95.	171.	371.	367.	25.
OHIO	10652.	1635.	2800.	5257.	5271.	328.
OKLAHOMA	2559.	392.	639.	1478.	1438.	67.
OREGON	2091.	325.	537.	1103.	1092.	[illegible]
PENN.	11794.	1806.	2905.	5988.	5850.	437.
RHODE I.	950.	146.	233.	477.	477.	34.
S. C.	2591.	417.	673.	1555.	1556.	82.
S. D.	666.	101.	183.	357.	384.	25.
TENN.	3924.	611.	932.	2354.	2257.	113.
TEXAS	11197.	1733.	2962.	6155.	6044.	276.
UTAH	1059.	166.	313.	625.	606.	42.
VERMONT	445.	68.	118.	248.	243.	21.
VIRGINIA	4648.	735.	1156.	2510.	2473.	144.
WASH.	3409.	533.	913.	1673.	1679.	111.
W. VA.	1744.	271.	417.	1046.	1032.	58.
WISCON.	4418.	667.	1244.	2337.	2312.	200.
WYOMING	332.	51.	95.	181.	178.	12.

*In thousands except for Effort, which is in millions.

TABLE 5-2 (Continued)

Sources:

Column 2: U. S., Bureau of the Census, 1970 Census of Population, Advance Report, General Population Characteristics, United States, PC(V2)-1 (Washington: Department of Commerce, February 1971).

Column 3: Ibid., and U. S., Congress, Public Law 90-576, Sec. 103(a), October 16, 1968.

Column 4: U. S., Department of Commerce, Statistical Abstract of the United States, 1970 (Washington: Government Printing Office, 1970), p. 116; and American Association of Junior Colleges, 1971 Junior College Directory (Washington: A.A.J.C., 1971), p. 88.

Columns 5 and 6: U. S., Bureau of the Census, 1970 Census of Population, Advance Report, General Population Characteristics, United States, PC(V2)-1 (Washington: Department of Commerce, February 1971); and U. S., Department of Commerce, Survey of Current Business, August 1971, p. 31.

Column 7: U. S., Department of Commerce, Survey of Current Business, August 1971, p. 31; and National Education Association, Estimates of School Statistics, 1969-70 (Washington: N.E.A., 1969), Tables 10 and 12.

Allotment formulas must depend upon a sound and defined rationale, and upon measurements that are reliable and periodically updated. There must be some logical connection between the base of allotment formulas and the reason that money is being distributed to states. Furthermore, allotment systems must be based upon measurements that cannot be manipulated by governments which would profit from their manipulation.

ALLOTMENT FORMULAS

Data for allotment formulas were obtained for the 1969-1970 school year. All data sources are cited under "sources" shown in Table 5-2. All measures for allotments appearing in Table 5-2 have been rounded to the nearest thousand, except for expenditure data used in calculating the effort base, which have been rounded to the nearest million.

Population. Population data are obtained from the 1970 Census.

Weighted population. This figure is derived from the 1970 Census by weighting age groups in the same manner as they are weighted in Section 103(a) of the Vocational Education Act. The formula for each state's weighted population is given below.

$$\text{Weighted population} = .59X + .23Y + .18Z$$

where

X = Age group 15 - 19, inclusive
Y = Age group 20 - 24, inclusive
Z = Age group 25 - 65, inclusive

Enrollment. Enrollment is the total 1969-1970 public and private school enrollment in grades K-12 and junior college.

Adjusted population. This is the population figure multiplied by an allotment ratio, which is the same as the allotment ratio used in the present Vocational Education Act.

$$\text{Allotment Ratio} = 1 - 1/2\ (\text{PC1}/\$3921)$$

The allotment ratio must be no smaller than .40 and no greater than .60

where

PCI = Per capita income for a state in 1970
$3921 = The per capita income for United States in 1970

Revised population. This figure represents the population multiplied by a revised allotment ratio designed to allow no state an allotment ratio less than .40, and a state with a per capita income equal to that of the national per capita income a revised allotment ratio of .50. Keeping the revised allotment ratio in the same format as the allotment ratio now being used, and rounding to the nearest .05, the revised allotment ratio is:

$$RA = .90 - .40\ (PCI/\$3921)$$

where

RA = Revised allotment ratio for a state
PCI = Per capita income for a state in 1970

The revised population formula is obtained by multiplying a state's population by its revised allotment (RA) ratio.

Effort. Effort is the 1969-1970 current expenditures for public and private schools, grades K-12, multiplied by a Federal reimbursement percentage. This percentage was obtained using the formula below.

$$FR = .25\ (PCI/\$3921) - .05$$

where

FR = Federal reimbursement percentage
PCI = Per capita income of a state

CRITERIA FOR NATIONAL GOALS

In addition to these allotment concepts and related formulas, statistical information which measured state achievement of various goals was identified. These measures served both as proxies for allotment concepts and as criteria for the extent to which national goals were achieved.

Criteria based upon goals of the Vocational Education Act of 1968 and upon general goals for Federal grants were stated in this author's dissertation, and criteria were derived from these goals.[4] State measurements of criteria, which were used as proxies for allotment concepts, were obtained by using the latest data available in November, 1971. Data are for the school year 1969-1970, unless otherwise noted. The measures for all criteria for each state are given in Tables 5-3 and 5-4.

Student Need

One measure used to estimate program load is student need. This criterion measures the number of high school students not expected to enroll in higher

TABLE 5-3 Measures Related to Goals - Part I

State (1)	Student Need (2)	Unemployment (In Hundreds) (3)	Vocational Education Growth (In Thousands) (4)	Jobs Obtained (5)
ALABAMA	294640	552	35664	7486
ALASKA	14518	92	4868	1451
ARIZONA	73573	230	17778	1618
ARKANSAS	152370	320	5441	3215
CALIF	1205483	4042	352019	57217
COLORADO	167326	264	21343	4971
CONNECT	144849	522	62182	5641
DELAWARE	35594	78	13670	2099
FLORIDA	461887	696	81573	13306
GEORGIA	324877	610	63438	5528
HAWAII	50348	98	2271	1688
IDAHO	48409	126	5683	1425
ILLINOIS	586419	1560	75555	13698
INDIANA	354010	692	24215	7362
IOWA	198920	318	65725	3385
KANSAS	117627	278	17170	2105
KENTUCKY	226968	478	31788	5238
LA	283011	676	33142	8395
MAINE	55849	178	10187	3066
MARYLAND	270282	462	58320	9586
MASS	329299	1076	72496	11836
MICHIGAN	711639	1636	93707	12355
MINN	268578	530	12191	11693
MISS	178675	362	7926	3302
MISSOURI	278073	728	53449	7848
MONTANA	40538	132	7725	962
NEBRASKA	88638	164	9299	2412
NEVADA	30184	116	5294	1157
NEW HAMP	46887	66	3772	839
NEW JERS	246490	1374	102539	9736
NEW MEX	82614	192	7147	4290
NEW YORK	902355	3190	487463	57520
NC	297458	708	96825	16455
ND	35254	104	5193	1477
OHIO	562991	1354	97222	15858
OKLAHOMA	183250	368	16300	3572
OREGON	133848	420	20809	3773
PENN	764699	1662	242371	29709
RHODE I	55159	152	7830	381
SC	223410	460	33333	7053
SD	42127	84	2367	1397
TENN	267712	616	19356	7157
TEXAS	929912	1316	47354	17433
UTAH	69559	212	17495	903
VERMONT	23512	70	6319	990
VIRGINIA	328294	492	56710	10446
WASH	238404	702	74348	4717
W VA	128628	396	23440	3246
WISCON	279832	678	34073	7295
WYOMING	11789	54	5363	545

TABLE 5-3 (Continued)

Sources:

Column 2: U. S., Department of Commerce, Statistical Abstract of the United States, 1970 (Washington: Government Printing Office, 1970), p. 116; U. S., Bureau of the Census, 1970 Census of Population, Advance Report, United States General Population Characteristics, PC(V2)-1 (Washington: Department of Commerce, February 1971); U. S., Office of Education, Digest of Educational Statistics, 1970 (Washington: Government Printing Office, 1970), pp. 62, 63, 69, and 88; and Digest of Educational Statistics, 1967 (Washington: Government Printing Office, 1967), p. 65.

Column 3: U. S., Department of Labor, Manpower Report of the President (Washington: Government Printing Office, April 1971), p. 270.

Column 4: U. S., Office of Education, Vocational and Technical Annual Report, Fiscal Year 1965 (Washington: Government Printing Office, 1968), pp. 32 and 39; and Vocational and Technical Annual Report, Fiscal Year 1968 (Washington: Government Printing Office, 1970), pp. 125 and 144.

Column 5: U. S., Office of Education, State Vocational Education Statistics, Fiscal Year 1969, Preliminary Report (Washington: Government Printing Office, 1970), pp. 15 and 18.

TABLE 5-4 Measures Related to Goals - Part II

State	Equalization	Expenditures (In Millions)
(1)	(2)	(3)
ALABAMA	$ 359940	$ 292
ALASKA	18150	58
ARIZONA	156810	274
ARKANSAS	196320	186
CALIF.	1330050	3473
COLORADO	192810	346
CONNECT.	139020	590
DELAWARE	44610	99
FLORIDA	430110	884
GEORGIA	408300	563
HAWAII	56550	145
IDAHO	78000	98
ILLINOIS	677070	1966
INDIANA	427230	824
IOWA	267810	604
KANSAS	178410	336
KENTUCKY	302820	374
LOUISIANA	406950	508
MAINE	107400	159
MARYLAND	276180	754
MASS.	318120	871
MICHIGAN	825030	1845
MINNESOTA	372750	737
MISS.	293070	195
MISSOURI	422700	691
MONTANA	74430	131
NEBRASKA	125250	179
NEVADA	28890	84
NEW HAMP.	59850	112
NEW JER.	339000	1487
NEW MEX.	130650	159
NEW YORK	721470	4718
N. CAROLINA	443370	599
N. DAKOTA	73560	90
OHIO	833190	1664
OKLAHOMA	225960	274
OREGON	173490	381
PENN.	795330	2190
RHODE I.	64320	168
S. CAROLINA	277770	289
S. DAKOTA	74910	97
TENN.	336210	423
TEXAS	1040820	1214
UTAH	133020	165
VERMONT	42450	88
VIRGINIA	365340	648
WASHINGTON	280470	570
W. VIRGINIA	155430	210
WISCONSIN	445470	929
WYOMING	36420	53

TABLE 5-4 (Continued)

Sources:

Column 2: U. S., Department of Commerce, *Survey of Current Business*, August 1971, p. 31.

Column 3: Ibid., and U. S., Department of Commerce, *Statistical Abstract of the United States, 1970* (Washington: Government Printing Office, 1970), p. 116; and American Association of Junior Colleges, *1971 Junior College Directory* (Washington: A.A.J.C., 1971), p. 88.

Column 4: National Education Association, *Estimates of School Statistics, 1969-70* (Washington: N.E.A., 1969), Tables 10 and 12; and U. S., Department of Commerce, *Statistical Abstract of the United States, 1970* (Washington: Government Printing Office, 1970), p. 116.

institutions and those students who begin higher education, but who are not expected to graduate with bachelor's degrees. The formula for student need for each state follows:

$$SN = S - [S(FC/P18)] + C - [C(G70/FC66)]$$

where

SN = Student need
S = Students in public and private high schools
FC = First-year college students from a state
$P18$ = Population aged 18, estimated by using the 1970 census count of population, ages 18 and 19
C = College students, full-time
$G70$ = College graduates with bachelor's degrees in 1970
$FC66$ = First-year college students in 1966 from a state

The variables before the addition sign on the right side of the equation represent the number of high school students who could benefit from vocational education during the 1969-1970 school year. The fraction FC/P18 is the percentage of high school students expected to enroll in higher education institutions, and was obtained by dividing the number of first-year college students from a state by the 18- to 19-year-old male population of that state.* FC/P18 is multiplied by the number of public and private high school students. The resulting product is then subtracted from the number of high school students to yield a figure representing those high school students not expected to enroll in college.

To obtain the number of college students who might benefit from vocational education, the number of them expected to graduate with bachelor's degrees was subtracted from the number of full-time college students. The percentage expected to graduate was found by dividing the number of 1969-1970 bachelor's degree graduates by first-year college students in the fall of 1966, four years earlier. College and high school students who could use vocational education were then added to obtain student need.

To account for student residency, the following assumptions and correction factors were used. The assumption was made that high school students were residents of the states in which they were enrolled. It was also assumed the college graduates were residents of the state in which their college enrollment was reported. However, a correction factor for residency was made for first-year college students. The enrollment of first-year college students of a state was multiplied by this factor. The residency correction factor was a fraction obtained by dividing the number of residents of a state enrolled in a degree program in any college throughout the country by the total number of persons enrolled in such a program in that state. The figures used for the calculation were from the fall of 1968, and were the latest figures available on residency. The adjustment factor increased first-year enrollment figures for states in which there was a net emigration of students to colleges and decreased first-year enrollment figures for states with a net immigration of college students. The adjustment factor could be used to encourage states to develop higher education facilities in relation to their high school populations.

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*The state population of 18-year-olds, male and female, was not available in November 1971. The 18- and 19-year-old male population was used as a proxy for all 18-year-olds.

Unemployment

Another criterion used to estimate program load was unemployment. It was reasoned that persons without demanded skills would add to unemployment and that vocational education might help decrease future unemployment by training persons now in school. Unemployment was measured for each state by averaging the number of unemployed persons in calendar years 1966-1970. A five-year average is a more stable figure than the 1970 statistic of unemployed, since the five-year average is more reliable, more comprehensive and reflects the number of unemployed during different parts of business cycles.

Vocational Education Growth

The program accomplishment concept was measured by two criteria: vocational education growth and jobs obtained. The calculations of the measures for these criteria are described below.

Vocational education growth is measured by the change in the number of vocational education students and the change in vocational education expenditures. Fiscal years 1965 to 1968 were used, because statistics for these years were the latest final figures available in November of 1971 from the U.S. Office of Education, and because FY 1965 was the first year of Federal funding under the Vocational Education Act of 1963. Inasmuch as the change in vocational education expenditures for all 50 states, from FY 1965 to FY 1968, was 149 times the change in the number of vocational education students for the same period, expenditures were multiplied by 1/149, so that changes in students were equivalent to changes in dollars. The formula for vocational education growth for a state is as follows:

$$VEG = [(EX68 - EX65)/149 + S68 - S65]/2$$

where

VEG = Vocational education growth
EX68 = Expenditures on vocational education, FY 1968
EX65 = Expenditures on vocational education, FY 1965
S68 = Students of vocational education, FY 1968
S65 = Students of vocational education, FY 1965

Jobs Obtained

Jobs obtained by vocational education graduates of secondary and post-secondary schools in fields related to their training were counted for fiscal year 1969, the only year for which these data had been published. States which trained a large percent of their students in vocations for which jobs existed, and which had good placement services, might well show relatively high jobs-obtained measures.

Equalization

A proxy for the fiscal need concept is the criterion of equalization. It is similar to state educational foundation programs because it includes both a minimum level of support for each student and a measure of effort based on a wealth proxy (state personal income). Equalization as a criterion was found by multiplying the public and private school enrollment by $750 and adding this product to the product of the junior college enrollment multiplied by $900. This sum was the minimum level of support set. Three percent of a state's personal income was then subtracted from this minimum level of support to yield the equalization measure. The formula for equalization is shown below:

$$E = \$750S + \$900JC - .03\,PI$$

where

E = Equalization
S = Students in public and private schools in grades K-12
JC = Junior college students
PI = Personal income

The minimum level of support for students in grades K-12 was set at $750, an even amount close to the national average current expenditures per student in average daily attendance in public schools in 1969-1970.[5] The minimum level of support set for junior college students was 1.2 times the $750 per student K-12 minimum, or $900. Three percent of a state's personal income is the highest even percent which will produce a positive equalization measure for all states given the minimum level of support set.

Expenditure

Expenditure measures were obtained by adding the expenditures that state and local governments made for education to those assumed to be made for private school students. To be sure that expenditures from the Federal Government were not counted, the amount of Federal aid was subtracted from total state and local expenditures. The formula below shows that the current public school expenditure figures from state and local revenue sources is multiplied by 1 (itself) plus the percentage that private school enrollment is of public school enrollment.

$$EX = SL(1 + P)$$

where

EX = Expenditures
SL = State and local current public school educational expenditures from state and local sources
P = Private school students in grades K-12 as a percent of the public school students, grades K-12.

ANALYSIS OF DIFFERENCES BETWEEN STATE ALLOTMENT PERCENTS AND CRITERIA

Procedure

To compare the state allotments (which result from each allotment formula) with the results of distributing money based on each criterion, data for allotments and criteria were changed into a common measure for each state. This measure was the percentage that each state's allotment or criterion measure was of the sum of the corresponding allotment or criterion measure for all 50 states. For example, if allotment formula "A" allowed Alabama $1 and the sum of all moneys allowed the 50 states under allotment formula "A" was $100, then Alabama's percentage of this $100 would be one percent. The resulting percentages are shown for each criterion in Tables 5-5 and 5-6, and for each allotment formula in Table 5-7.

An ideal allotment formula relative to a criterion would reward states by giving them a percentage of funds equal to the percentage that a state's criterion measure was of the sum of states' criterion measures. An allotment formula which gave a state a greater percentage of money than the state's percent of the sum of a criterion measure would be paying a state too generously in relation to the criterion being studied. Allotment formulas which paid a state less than the state's percentage of the sum of a measure would be paying the state too little in relation to that criterion. One method of measuring this is by summing the absolute values of the difference between each state's allotment and criterion percentage, and dividing the sum for all states by 2.

This total, called "Percent Shift" in this study, shows the percent of the total allotted funds which would be moved from one group of states to another group of states if the allotment formula were used in place of the criterion. The lower the percent shift is for any suggested formula, the better that allotment formula matches the criterion measures. The percent shifts between each allotment formula and criterion are shown in Table 5-8.

TABLE 5-5 State Percent of National Totals for Measures Related to Goals - Part I

State (1)	Student Needs (2)	Unemployment (3)	Vocational Education Growth (4)	Jobs Obtained (5)
ALABAMA	2.293	1.742	1.345	1.805
ALASKA	0.113	0.290	0.184	0.350
ARIZONA	0.573	0.726	0.670	0.390
ARKANSAS	1.186	1.010	0.205	0.775
CALIF.	9.384	12.756	13.275	13.793
COLORADO	1.302	0.833	0.805	1.198
CONNECT.	1.128	1.647	2.345	1.360
DELAWARE	0.277	0.246	0.515	0.506
FLORIDA	3.595	2.197	3.076	3.208
GEORGIA	2.529	1.925	2.392	1.333
HAWAII	0.392	0.309	0.086	0.407
IDAHO	0.377	0.398	0.214	0.344
ILLINOIS	4.565	4.923	2.849	3.302
INDIANA	2.756	2.184	0.913	1.775
IOWA	1.548	1.004	2.479	0.816
KANSAS	0.916	0.877	0.647	0.507
KENTUCKY	1.767	1.509	1.199	1.263
LA.	2.203	2.133	1.250	2.024
MAINE	0.435	0.562	0.384	0.739
MARYLAND	2.104	1.458	2.199	2.311
MASS.	2.563	3.396	2.734	2.853
MICHIGAN	5.539	5.163	3.534	2.978
MINN.	2.091	1.673	0.460	2.819
MISS.	1.391	1.142	0.299	0.796
MISSOURI	2.165	2.298	2.016	1.892
MONTANA	0.316	0.417	0.291	0.232
NEBRASKA	0.690	0.518	0.351	0.581
NEVADA	0.235	0.366	0.200	0.279
NEW HAMP	0.365	0.208	0.142	0.202
NEW JER.	1.919	4.336	3.867	2.347
NEW MEX.	0.643	0.606	0.270	1.034
NEW YORK	7.024	10.068	18.383	13.866
N. C.	2.315	2.234	3.651	3.967
N.D.	0.274	0.328	0.196	0.356
OHIO	4.382	4.273	3.666	3.823
OKLAHOMA	1.426	1.161	0.615	0.861
OREGON	1.042	1.326	0.785	0.910
PENN.	5.952	5.245	9.140	7.162
RHODE I.	0.429	0.480	0.295	0.092
S. C.	1.739	1.452	1.257	1.700
S.D.	0.328	0.265	0.039	0.377
TENN.	2.084	1.944	0.730	1.725
TEXAS	7.238	4.153	1.786	4.202
UTAH	0.541	0.669	0.660	0.218
VERMONT	0.183	0.221	0.238	0.239
VIRGINIA	2.555	1.553	2.139	2.518
WASH.	1.856	2.215	2.804	1.137
W. VA.	1.001	1.250	0.884	0.782
WISCON.	2.178	2.140	1.285	1.759
WYOMING	0.092	0.170	0.202	0.131

Sources: Columns 2-5: To obtain each figure in Table 5-5, the corresponding figure in Table 5-3 is divided by the sum of the column in which it is found.

TABLE 5-6 State Percent of National Totals for Measures Related to Goals - Part II

State (1)	Equalization (2)	Expenditures (3)
ALABAMA	2.313	0.864
ALASKA	0.117	0.172
ARIZONA	1.008	0.811
ARKANSAS	1.261	0.549
CALIF.	8.546	10.278
COLORADO	1.239	1.023
CONNECT.	0.893	1.745
DELAWARE	0.287	0.294
FLORIDA	2.764	2.616
GEORGIA	2.623	1.665
HAWAII	0.363	0.430
IDAHO	0.501	0.290
ILLINOIS	4.350	5.819
INDIANA	2.745	2.438
IOWA	1.721	1.787
KANSAS	1.146	0.994
KENTUCKY	1.946	1.105
LA.	2.615	1.505
MAINE	0.690	0.471
MARYLAND	1.775	2.231
MASS.	2.044	2.576
MICHIGAN	5.301	5.459
MINN.	2.395	2.161
MISS.	1.883	0.576
MISSOURI	2.716	2.045
MONTANA	0.478	0.388
NEBRASKA	0.805	0.530
NEVADA	0.186	0.248
NEW HAMP	0.385	0.332
NEW JER.	2.178	4.400
NEW MEX.	0.839	0.471
NEW YORK	4.636	13.963
N. C.	2.849	1.771
N. D.	0.473	0.266
OHIO	5.354	4.925
OKLAHOMA	1.452	0.811
OREGON	1.115	1.129
PENN.	5.110	6.480
RHODE I.	0.413	0.498
S. C.	1.785	0.857
S. D.	0.481	0.287
TENN.	2.160	1.251
TEXAS	6.688	3.552
UTAH	0.855	0.487
VERMONT	0.273	0.261
VIRGINIA	2.347	1.918
WASH.	1.802	1.687
W. VA.	0.999	0.621
WISCON.	2.862	2.748
WYOMING	0.234	0.155

Sources: Columns 2-3: To obtain each figure in Table 5-6, the corresponding figure in Table 5-4 is divided by the sum of the column in which it is found.

TABLE 5-7 State Percent of National Total Under Each Accepted Allotment Formula

State (1)	Population (2)	Weighted Population (3)	Enroll-ment (4)	Adjusted Population (5)	Revised Population (6)	Effort (7)
ALABAMA	1.701	1.710	1.663	2.046	2.069	1.282
ALASKA	0.149	0.151	0.153	0.124	0.129	0.142
ARIZONA	0.875	0.873	0.885	0.951	0.933	0.913
ARKANSAS	0.950	0.927	0.910	1.142	1.168	0.835
CALIF.	9.857	9.999	10.080	8.604	8.830	8.903
COLORADO	1.090	1.117	1.134	1.122	1.112	1.069
CONNECT.	1.498	1.481	1.480	1.201	1.211	1.339
DELAWARE	0.271	0.270	0.294	0.243	0.248	0.263
FLORIDA	3.354	3.191	2.978	3.599	3.540	2.896
GEORGIA	2.268	2.302	2.208	2.613	2.537	2.054
HAWAII	0.380	0.393	0.405	0.322	0.333	0.362
IDAHO	0.352	0.354	0.373	0.414	0.401	0.370
ILLINOIS	5.490	5.442	5.532	4.686	4.833	4.931
INDIANA	2.566	2.566	2.592	2.663	2.636	2.577
IOWA	1.396	1.359	1.472	1.481	1.460	1.948
KANSAS	1.111	1.108	1.107	1.141	1.132	1.037
KENTUCKY	1.590	1.600	1.525	1.912	1.863	1.502
LA.	1.800	1.807	1.887	2.164	2.117	2.064
MAINE	0.491	0.477	0.520	0.575	0.557	0.597
MARYLAND	1.938	1.951	1.980	1.776	1.803	2.032
MASS.	2.810	2.776	2.699	2.501	2.555	2.275
MICHIGAN	4.384	4.405	4.846	4.238	4.255	5.281
MINN.	1.880	1.842	2.059	1.930	1.914	2.274
MISS.	1.095	1.085	1.176	1.317	1.394	0.962
MISSOURI	2.310	2.261	2.397	2.443	2.410	2.218
MONTANA	0.343	0.345	0.369	0.391	0.380	0.471
NEBRASKA	0.733	0.718	0.744	0.766	0.758	0.566
NEVADA	0.242	0.242	0.245	0.202	0.210	0.207
NEW HAMP	0.365	0.357	0.356	0.396	0.389	0.374
NEW JER.	3.541	3.487	3.385	2.935	3.048	3.627
NEW MEX.	0.502	0.502	0.575	0.603	0.582	0.625
NEW YORK	8.987	8.872	8.463	7.203	7.422	10.972
N. C.	2.511	2.624	2.367	2.974	2.873	2.288
N.D.	0.305	0.306	0.327	0.367	0.363	0.372
OHIO	5.262	5.265	5.353	5.204	5.201	4.896
OKLAHOMA	1.264	1.262	1.222	1.463	1.419	1.008
OREGON	1.033	1.047	1.027	1.092	1.077	1.223
PENN.	5.826	5.816	5.553	5.829	5.812	6.534
RHODE I.	0.469	0.470	0.445	0.473	0.471	0.507
S. C.	1.280	1.343	1.287	1.539	1.535	1.228
S.D.	0.329	0.325	0.350	0.393	0.379	0.377
TENN.	1.928	1.968	1.782	2.331	2.266	1.692
TEXAS	5.531	5.581	5.662	6.093	5.964	4.131
UTAH	0.523	0.535	0.598	0.619	0.598	0.627
VERMONT	0.220	0.219	0.226	0.246	0.240	0.307
VIRGINIA	2.296	2.367	2.210	2.485	2.440	2.149
WASH.	1.684	1.716	1.745	1.656	1.657	1.666
W. VA.	0.862	0.873	0.797	1.036	1.018	0.861
WISCON.	2.183	2.148	2.378	2.314	2.281	2.991
WYOMING	0.164	0.164	0.182	0.180	0.176	0.177

Sources: Columns 2-7: To obtain each figure in Table 5-7, the corresponding figure in Table 5-2 is divided by the sum of the column in which it is found.

TABLE 5-8 The Sums of the Percent Shift between Allotment Percents and Criterion Percents

	Allotment Formulas					
Criteria	Population	Weighted Population	Enrollment	Adjusted Population	Revised Population	Effort
Student Need[a]	7.68	7.59	7.57	5.29	5.22	10.30
Unemployment[b]	8.91	8.89	8.90	12.35	11.66	9.04
Vocational Educ. Growth[c]	21.52	21.40	22.37	25.11	24.62	20.28
Jobs Obtained[d]	15.40	15.17	16.03	17.63	17.30	14.56
Equalization[e]	11.17	10.92	10.03	6.62	7.10	11.85
Expenditures[f]	10.43	10.57	10.12	15.33	14.61	7.33

[a] High school and college students not expected to attain bachelor's degrees.

[b] Five-year average number of unemployed.

[c] Growth of vocational education students and expenditures.

[d] Graduates with jobs in fields related to their training.

[e] Minimum level of support less three percent of personal income, where minimum level of support is $750 per public and private school student in grades K-12 and $900 per junior college student.

[f] Current public and private school expenditures from local sources for grades K-12.

Table 5-8 indicates that the effort formula has the lowest percent shift of the six formulas when compared with three criteria: (a) the growth of vocational education students and expenditures (vocational education growth), (b) graduates with jobs in fields related to their training (jobs obtained), and (c) current public and private school expenditures from local sources for grades K-12 (expenditures). These criteria are all the criteria classified under the program accomplishment and fiscal effort concepts. Hence, these two concepts are best matched by the effort formula.

The two concepts classified under program load are high school and college students not expected to attain bachelor's degrees (student need) and five-year average number of unemployed (unemployment). The former has the lowest percent shift when compared with the revised population allotments, and the latter criterion has the smallest percent shift when matched with the weighted population allotments.

The revised population allotment formula favors states having relatively poor per capita personal income. Those states would probably send a smaller percent of their students through colleges, and thus would tend to have relatively high need measures. This explains the small percent shift for student needs and the revised population formula.

A reason that state unemployment percentages match weighted population allotments so well is that both measures put great weight on the population below age 25. Unemployment in this age group is higher than it is for the rest of the population, and so this young group contributes disproportionately to the number of unemployed. Over 80 percent of the weighted population figure depends upon the same age group.

The criterion of equalization, under the concept of fiscal need, has the lowest percent shift when compared to the adjusted population formula. Relatively low personal income makes both the criterion and the allotment formula measures small.

Results for All Criteria

To find which allotment formula best matches all criteria, the percent shift for each criterion has been added to give a sum for each formula. This procedure assumes that each criterion is as important as any other criterion. The formula with the lowest sum, as shown in Table 5-9, is the effort formula. However, all formulas, except the adjusted population and revised population formulas, have sums within 1.75 of each other.

TABLE 5-9 U.S. Sums of Percent Shifts for All Criteria

Sums of Percent Shift	ALLOTMENT FORMULAS					
	Population	Weighted Population	Enrollment	Adjust. Population	Revised Population	Effort
Differences	75.11	74.54	75.02	82.33	80.51	73.36

Since the sums represent all six criteria, dividing this figure by six yields the average percent shift between the distribution based on an allotment formula and the distribution based on the average of all criteria. Thus, the average percent shift ranges from 12.23 for the effort formula to 13.72 for the adjusted population formula. Although this range is only 1.51 percent of an appropriation, it might be important for large appropriations. For example, with a half-billion dollar appropriation, $7,550,000 would be redistributed from one group of states to another if different allotment formulas were used.

Other sums can be obtained if the percent shift for various criteria are weighted depending upon the relative value attached to each criterion and the degree of confidence in the validity of the statistics used to measure each criterion. However, this analysis assumes that all criteria are equally important.

EFFECTS OF ALLOTMENT FORMULAS ON STATES GROUPED BY STATE CHARACTERISTICS

All states were listed in order according to three different characteristics: per capita personal income, percentage of elementary and secondary students in private schools, and percentage of the state's population living in metropolitan areas. The 50 states were then divided into five groups for each list, so that the ten states with the smallest measures of each characteristic were in the first quintile for that characteristic.

The characteristics chosen by which to rate states are important for different reasons. It is assumed that states with low per capita personal incomes will benefit from allotment formulas based upon per capita income. Some allotment formulas discriminate against states with high percentages of private school enrollment.

Urban schools often have high education costs and large groups of minority students, increasing their need for funds. To identify urban states, the statistic of metropolitan areas was chosen over the more publicized one of standard metropolitan statistical area (SMSA), because the percent of the U.S. population living in all SMSA's was larger than the percent of the population living in metropolitan areas.

Per Capita Personal Income

The formula which gave the largest allotments to groups of states with low per capita personal incomes was the adjusted population formula. The best formula for groups of states with high per capita personal incomes is the effort formula. The results for each quintile, when states are placed by per capita personal income, are shown in Table 5-10. The formula which is most generous to the first three quintiles of states is the adjusted population formula, which is also the least generous formula for the fifth quintile — the richest states. The fourth quintile is most favored by the effort formula. But the richest states in the fifth quintile would receive slightly more money from the population formula, or from the weighted population formula, than they would receive from the effort formula.

If the purpose of grants is especially to aid low per capita income states, more aid can be given to them by using the adjusted population formula than by using any other studied formula. An adjusted weighted population formula, which multiplied the weighted population by the allotment ratio, would be even more generous to poor states.

Private School Enrollment

To find which allotment formula gives the largest allotments to states with a large percent of their students in private schools, the number of private school students in grades K-12 was divided by the total number of students in those grades for each state. The resulting quotient was the percent of students enrolled in private school. States were listed in order, so that North Carolina, with only 1.7% of its

TABLE 5-10 Percent of Total Allotment Received by States, Grouped According to Their Per Capita Personal Income*

Quintiles Based Upon State Per Capita Personal Income	Allotment Formulas					
	Population	Weighted Population	Enrollment	Adjusted Population	Revised Population	Effort
1	12.023	12.121	11.929	14.457	14.375	11.423
2	13.832	14.024	13.895	15.781	15.348	12.230
3	14.709	14.485	14.629	15.707	15.464	15.455
4	26.210	26.256	26.814	26.032	25.993	27.873
5	33.225	33.113	32.736	28.021	28.819	33.021

TABLE 5-11 Percent of Total Allotment Received by States Based Upon Their Percent of Private School Students*

Quintiles Based Upon State Private School Student Percentage	Allotment Formulas					
	Population	Weighted Population	Enrollment	Adjusted Population	Revised Population	Effort
1	11.750	11.969	11.450	13.758	13.556	10.532
2	18.322	18.346	18.020	20.118	19.848	16.179
3	18.184	18.345	18.579	17.771	17.834	17.530
4	19.841	19.772	20.919	20.047	19.981	21.645
5	31.902	31.567	31.035	28.304	28.780	34.116

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*Percents do not add up to 100% due to rounding.

students in private school, was first, and Rhode Island, with 20.3 percent, was last. States were then divided into five groups of ten states, and each quintile was examined to find which allotment formulas favored each group of states. The results are shown in Table 5-11.

The lowest two quintiles of states receive the most money under the adjusted population formula. Groups of states with high percentages of private school students, including the highest two quintiles, are most favored by the effort formula. This formula is least generous to state groups with small percentages of private school students. The third quintile is allotted the least money under the effort formula, but the most under the enrollment formula. However, the difference between the enrollment formula's allotment percent for the third quintile (18.5 percent) and the adjusted population allotment percent (17.77 percent) is only .81 of 1 percent.

The effort formula is the only formula that accounts for private school enrollment directly, and is the most favorable formula for states with comparatively high percentages of private school students. The adjusted population allotments favor states with low per capita income. It is probable that persons with small per capita incomes do not use private schools as much as richer persons because of the added costs of sending children to private schools. Indeed, many states with low private school enrollment percentages also have low per capita incomes. For example, of the ten states with the lowest private school percentages, all but two are in the lowest two quintiles when states are ranked by per capita incomes. The two exceptions are Nevada and Alaska.

Metropolitan Population

To find the allotments that most favored metropolitan areas, the percent of a state's population which lives in metropolitan areas was obtained and states ranked according to this percentage. These ranked states were then divided into quintiles and the effect of allotments on these groups was found. The results are shown in Table 5-12.

States with the smallest percent of metropolitan population, which rank in the first four quintiles of states, receive the highest allotments under the adjusted population formula. States with the largest percentage of metropolitan population in the fifth quintile benefit most from the effort allotment formula.

Most states with high percentages of metropolitan population are also states with high per capita incomes. Every state in the top quintile of states ranked by metropolitan population percentages is in the fourth or fifth quintile of states ranked by per capita income.

TABLE 5-12 Percent of Total Allotment Received by States, Grouped By the Percent of Their Population Which Lives in Metropolitan Areas*

Quintiles Based Upon States' Metropolitan Population Percentage	Allotment Formulas					
	Population	Weighted Population	Enrollment	Adjusted Population	Revised Population	Effort
1	3.950	3.928	4.251	4.610	4.601	4.400
2	12.062	12.171	11.787	13.850	13.615	11.647
3	19.975	20.018	20.203	22.081	21.747	20.524
4	23.216	23.195	23.740	23.927	23.718	21.949
5	40.796	40.687	40.022	35.530	36.318	41.482

*Percents do not add up to 100% due to rounding.

HOW MUCH SHOULD THE FEDERAL GOVERNMENT CONTRIBUTE FOR VOCATIONAL EDUCATION?

Although the Federal Government has contributed funds for vocational education in public schools since 1917, the rationale for the amount contributed annually has not been clearly formulated. Ideally, national goals for vocational education should be established and then the amount of Federal dollars required to achieve these goals should be computed. To do this requires a clear delineation of responsibility between the Federal Government and the states.

For public elementary and secondary education, it is assumed that financial support is available to pay the cost of general education programs, but additional funds needed to pay for the higher costs of vocational courses are most difficult to obtain. This difficulty retards the introduction of vocational education into public schools, and consequently, Federal categorical aids for vocational education should be designed to pay the additional costs incurred in substituting vocational courses for general education courses in public elementary and secondary schools.

In order to estimate the total cost incurred by public schools in substituting vocational instruction for general education, it is necessary to establish values for three quantities. The first of these is the percentage of public elementary and secondary school students who are vocational students, i.e., students who receive some instruction in vocational education courses (hereafter referred to as P_1). In recent years, about one-third of all public high school students have received some instruction in vocational subjects.

A second needed percentage (P_2) is that percent of school time the average vocational student spends in vocational courses. If a student spends twelve years in the public schools and during his eleventh and twelfth years he spends one-half of his school time in vocational courses, he would have spent one-twelfth, or eight and one-third percent of his total school time in vocational courses.

A third needed percentage (P_3) is the percent by which the average annual current cost per student in vocational courses exceeds the corresponding average costs for all other courses. If the comparison is made with all other high school courses, this percent could be between 60 percent and 90 percent. If the comparison is made with the average costs of all other education courses in public elementary and secondary schools, the percentage probably would be greater. In estimating the total national added cost incurred by public schools for vocational education, a value of 75 percent has been used for P_3.

If a national goal is to have 50 percent of all public school students receive a full year of vocational education, then the additional cost to the public schools would be calculated as shown below. (The \$36 billion is the estimated total current expenditure for public elementary and secondary day schools for the 1970-71 school year rounded to the nearest billion.)

$$\text{Additional cost} = \frac{P_1 P_2 P_3}{1 + P_1 P_2 P_3} \times \left[\text{Total current cost of public elementary and secondary education}\right]$$

$$\text{Additional cost} = \frac{1/2\ (1/2)\ (3/4)}{1 + 1/2\ (1/12)\ (3/4)} \times [\$36 \text{ billion}]$$

$$\text{Additional cost} = .03 \times \$36 \text{ billion} = \$1.08 \text{ billion}$$

The preceding calculations assume that the public schools are to be helped by the Federal Government to attain the suggested goals as represented by the fractions used for P_1 and P_2, and that the cost per student for vocational education is 75 percent more than the average cost per student for general education. Furthermore, the calculations are based upon an annual current expenditure for elementary and secondary education of \$36 billion. If these conditions are assumed, then the additional costs incurred by public schools for vocational education courses would be \$1.08 billion per school year.

This relationship between national goals for vocational education and additional costs incurred by public schools provides a basis for determining the amount of Federal funds which should be appropriated for grants-in-aid to states. The amount appropriated should be sufficient to assure that each state is able to pay the additional costs incurred in attaining the national vocational education goals. With recent emphasis on "career education," it should be possible to estimate the percentage of all public school students who need saleable skills upon graduation from high school, and then to estimate the percent of school time needed in vocational courses to develop these skills. With these national policies established, the amount of funds required to pay the additional costs of vocational courses can be calculated from the foregoing formula. Federal contributions to the states, equivalent to this amount, would provide assurance that the states have the necessary funds to pay the additional costs incurred.

It may be that in some states these extra costs are incurred in junior colleges during the thirteenth and fourteenth years. This would be an appropriate option for states to exercise, since the major goal is to develop saleable skills for students.

Federal funds for retraining adults would need to be estimated as an addition to the amounts estimated for elementary and secondary schools, plus junior colleges. These estimates would be based on recent information concerning costs incurred for adult vocational education and the number of adults educated.

Formulas for Allotments

Allotment formulas must be based on a sound rationale and calculated by using dependable figures, subject to periodic updating, and not capable of manipulation by school officials. Six formulas which meet these requirements were investigated.

Formulas were judged by the closeness with which the state allotments they produced approximated state percentages of six criteria. These criteria were obtained after a review of recent literature on vocational education and general purposes of grants-in-aid. This review resulted in a list of goals. Criteria were used for those goals for which quantifiable data were readily available for the 50 states.

To find which allotment formula resulted in a distribution of funds to states most similar to that which would occur if state criteria were used as the basis for distribution, the percent of funds that would shift from one state to another was computed. These computations related each criterion with each allotment formula. The allotment formula which produced the lowest total shift for each criterion can be identified as the best formula for each criterion. Table 5-13 lists the allotment formula which had the lowest percent shift when compared to each criterion.

Program accomplishment includes two criteria: jobs obtained and vocational education growth. Both criteria are best matched by the effort allotment formula which is, therefore, the best formula for the program accomplishment concept. The same formula best matches the effort criterion.

The formula which corresponds best with equalization and the concept of fiscal need is the adjusted population formula. As compared to the revised population formula, it allots less money to very wealthy states.

The present formula combines weighted population and the allotment ratio, based on per capita income used in the adjusted population formula of this study. It is slightly more equalizing than the adjusted population formula, since the weighted population formula is slightly more equalizing than the population formula. As shown in Table 5-14, nineteen states benefit most from the adjusted population formula, but this study shows that this formula is the worst of the acceptable allotment formulas in allocating moneys to states in proportion to criteria representing state educational fiscal efforts and program accomplishment.

The results of this study show that several compromise formulas would produce allotments which were fairly close to each other. One of these was the weighted population formula. If slightly greater emphasis were to be placed on fiscal need and program load, as opposed to program accomplishment, then the present formula would be appropriate.

TABLE 5-13 Allotment Formulas Which Best Match Criteria

Criterion	Allotment Formula
Student need	Revised population
Unemployment	Weighted population
Vocational education growth	Effort
Jobs obtained	Effort
Equalization	Adjusted population
Expenditure	Effort

TABLE 5-14 The Formula Which Allows the Largest Allotment for Each State

Population

Connecticut
Massachusetts

Weighted population

-

Enrollment

Alaska
California
Colorado
Delaware
Hawaii
Illinois
Nevada
Ohio
Washington
Wyoming

Adjusted population

Arizona
Florida
Georgia
Idaho
Indiana
Louisiana
Kansas
Kentucky
Missouri
Nebraska
New Hampshire
North Carolina
Oklahoma
South Carolina
South Dakota
Tennessee
Texas
Virginia
West Virginia

Revised population

Alabama
Arkansas
Mississippi

Effort

Iowa
Maine
Maryland
Michigan
Minnesota
Montana
New Jersey
New Mexico
New York
North Dakota
Oregon
Pennsylvania
Rhode Island
Utah
Vermont
Wisconsin

Changing to one of the alternative formulas studied is not recommended, unless much greater emphasis upon program accomplishment is desired. This might occur if general education grants accounted for fiscal need by basing payments on a per capita personal income ratio similar to the one now used in the Vocational Education Act. Ideally, such a general education grant would not limit the allotment ratio to between .40 and .60. With fiscal need thus accounted for by these grants, vocational education grants could be used to encourage program accomplishment, and the effort formula could be used.

RECOMMENDATIONS

1. National goals for vocational education should be established with sufficient precision so that the cost of attaining them can be estimated. Congress has stated the purposes of its appropriations for vocational education, but has not established goals. These should be established by specifying a percent of public school students for whom vocational education is to be available and the average percent of school time which they must devote to such instruction. With this information, the additional costs required in public schools can be estimated.

2. The Federal government should appropriate for the support of vocational education each year an amount sufficient to pay the additional costs incurred by public schools (including post-high schools) in providing the required vocational courses. This approach assumes that general funds for the support of public schools and colleges are available for vocational courses, but that these funds are insufficient to pay the higher costs usually incurred for vocational causes. If the additional funds needed are supplied by the Federal government, it should be possible to attain the established goals for vocational education, utilizing existing sources of public school funds and a modest increase in Federal aid to the states for vocational education.

3. Federal funds for vocational education should be apportioned among the states in accordance with the formula established in the Vocational Act of 1968. An examination of alternative formulas, some emphasizing "reward for accomplishments" and other stressing "fiscal need," revealed the inherent conflict in these concepts of Federal participation in financing education. The former tends to allocate more funds to the industrial states; the latter, to low-income, rural states. Since there is merit in both approaches, the compromise represented by the present apportionment formula is recommended at least until more precise data are available concerning number of students served by vocational programs and their costs.

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CHAPTER VI

STATE ADMINISTRATION OF VOCATIONAL EDUCATION FUNDS

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LEGISLATIVE BACKGROUND

This chapter is primarily concerned with the states' administration of Federal vocational education funds. Most states do not allocate additional funds for vocational education beyond their basic foundation program for all students. Federal aid to vocational education has a long history, as already described in earlier chapters. To review briefly, however, the Smith-Hughes Act of 1914 extended Federal vocational education funding down to the high school level.[1] Subsequent legislation allowed Federal vocational education funds to be used by high school districts for costs of administration, equipment and supplies, and part-time post-secondary vocational education. The Vocational Education Act of 1963 added support for area vocational technical schools, vocational boarding schools, and work-study programs.[2]

The 1968 amendments to the Vocational Education Act expanded program activities and increased appropriations so greatly that the results were almost a complete rewrite of the Act of 1963. The needs of people were emphasized with earmarked funds for the disadvantaged, handicapped and post-secondary students. Special support was also given to consumer and homemaking education, as well as vocational counseling and training programs in private vocational institutions.[3]

A truly equalized system of distributing funds to local school districts has long been a goal in school finance. The fact that this goal has not been achieved is evidenced by the numerous court actions that have been brought against existing state systems of school finance. In May of 1972, the House Committee on Education and Labor summarized 26 lawsuits in 18 states that have challenged the state school finance systems.[4] The Serrano vs. Priest decision rendered in the Supreme Court of California on August 30, 1971 was considered a landmark among these court actions. Speaking for the Court, Justice Sullivan stated:

> We are called upon to determine whether the California public school financing system, with its substantial dependence on local property taxes and resultant wide disparities in school revenue, violates the equal protection clause of the Fourteenth Amendment. We have determined that this funding scheme invidiously discriminates against the poor because it makes the quality of a child's education a function of the wealth of his parents and neighbors. Recognizing as we must that the right to an education in our public schools is a fundamental interest

> which cannot be conditioned on wealth, we can discern no compelling state purpose necessitating the present method of financing. We have concluded, therefore, that such a system cannot withstand constitutional challenge and must fall before the equal protection clause.[5]

After this adverse judgment, the California Supreme Court returned the Serrano-Priest case to the trial court to allow the defendants, including the State of California, a reasonable time to correct the state school finance system.

The Serrano-Priest decision did not specify how California's school finance system must be changed. John Coons, Professor of Law, University of California at Berkeley, recently declared that "There is just one 'Yes' in the whole Serrano opinion, and that is, of course, itself a 'No' – you may not tie spending to wealth."[6] Although school finance and legal scholars will continue to debate the specific meanings of these decisions for quite some time, it is very clear that the courts, too, are now demanding the establishment of a genuinely equalized system of distributing funds to local school districts.

Federal legislation governing the distribution of Federal vocational education funds to states has moved in the same general direction as the Serrano-type court decisions. In fact, one of the most significant fiscal provisions added by the 1968 Vocational Education Amendments was a requirement introducing the equalization process into the distribution of vocational funds from state to local districts. State plans were required to set forth policies and procedures for distributing Part B funds which assured that due consideration would be given to the following local district allocation criteria:

1. Manpower Needs
2. Vocational Education Needs
3. Relative Ability to Support Programs
4. Costs of Vocational Education Programs in Excess of the Costs Normally Attributed to the Costs of Education in Such Local Agencies

The Act further emphasized that local districts with different needs and wealth were to receive different levels of support, saying, "Funds made available under this title (Part B) will not be allocated to local educational agencies in a manner, such as a matching of local expenditures at a percentage ratio uniform throughout the state, which failed to take into consideration the criteria (stated above). . . ."[7]

The foregoing allocation criteria comprise a clear expression of Congressional intent that a broad definition of a "truly equalized system" of distributing Federal vocational education funds should be followed. Equalization of educational opportunities for students defined as "equal access to a suitable education"[8] appears to meet this Congressional intent. It must be understood that equalization is more than equal expenditures per pupil. A suitable education would consider the needs of the communities' employers and the needs of the students for different educational programs. Equal access to these programs would recognize that these different programs have different costs per student, and that districts vary in their relative ability to support these programs.

Current State Allocation Practices

During the 1969-70 school year, in an attempt to determine the practices followed in distributing vocational education funds from the states to local districts, the research staff of this project visited the state vocational education departments in the following 15 states: California, Colorado, Florida, Illinois, Michigan, Minnesota, New Hampshire, New York, Ohio, Oregon, Tennessee, Texas, Utah, Washington, and Wisconsin. As previously reported,[9] there was general agreement among the sample states that the federally mandated allocation criteria (Manpower Needs, Vocational Education Needs, Relative Ability to Pay, and Excess Costs) were sound bases for distributing vocational education funds from states to local districts. However, a number of problems and issues with these criteria were unresolved at that time.

Manpower Needs. All states ranked manpower needs very high as a criterion for distributing vocational education funds to local districts, yet only two states had developed systems for defining local district manpower needs in a quantified form that could be used in an allocation formula. In fact, many vocational educators raised this question, "Should the definition of manpower needs of the local educational agency include local, regional, state, or national employment data?" The most frequent treatment of manpower needs was for the state to require that the local district plan and applications give due consideration to the manpower needs of their districts in order to qualify for Part B funds. A local education agency could satisfy this requirement merely by including a statement that its district's manpower needs would be taken into account in planning its program. All surveyed states reported problems in defining district manpower needs with sufficient specificity to furnish valid data for their allocation systems.

Vocational Education Needs. These were easier to define than manpower needs; most states used simple enumerations of regular, handicapped, and disadvantaged students as a description of their districts' vocational education needs. Four states defined district vocational education needs in terms of such non-enrollment data as ethnic composition of the school population, the unemployment rate of an area, and the school dropout rate. Once the method of defining the vocational education needs of the local education agency was chosen, fewer difficulties were encountered with this criterion than with manpower needs.

Relative Ability to Pay. Equalization of educational opportunity was sought by the Federal allocation criterion which required that consideration be given to the districts' relative abilities to pay for their educational programs. No difficulties were reported by states in implementing this requirement. Most states measured the relative financial abilities of their districts in terms of a comparison of the district's assessed valuation per pupil with the state's average assessed valuation per pupil. Other states compared the local district's tax levy to the state's average tax levy. Three states ranked their districts according to the district's index of economic ability which included such components as state retail tax collected, motor vehicle registration, and farm products sold in the district.

Excess Costs. After determination of the foregoing needs, a final district criterion to be considered was the excess cost of the vocational education programs. This was defined as that cost of vocational education which is in excess of the cost normally attributed to general educational program costs in the local district. Eight of the sample states followed this definition closely by comparing each local district's per-pupil cost of vocational education to its state's average per-pupil cost of general education. Three states compared the local district's per-pupil cost of vocational education with the local district's per-pupil cost of general education. Three other states compared the local district's cost of vocational education with the state's average per-pupil cost of vocational education. One state compared the local district's per-pupil cost of vocational education with the state's per-pupil foundation program amount. The involved states reported having more difficulty with the excess cost criterion than with any of the other federally mandated criteria. From the above practices, it was easy to see that there was confusion among states concerning the basic definition of excess cost. Further, after states had defined excess cost, few had developed sufficiently accurate reporting procedures to supply the data for their definitions.

Implementation Practices. The practices involved in implementing the above criteria in the 15 sample states fell into two general types:

1. Allocation Formulas

2. Allocation Ranking Systems

The formula systems employed in four states attempted to quantify the allocation criteria into objective data for each local district. Examples of the types of data quantified were average daily attendance, adjusted assessed valuation per student, local tax rates, unemployment rates, the number of job opportunities, and the cost of the local vocational education program in excess of the cost of general education programs. Formula systems were used in an attempt to make the allocation process completely impersonal and objective. An advantage of the formula systems was the fact that they could be readily computerized.

The ranking systems for allocation of Part B funds used by 11 of the 15 states treated the allocation criteria more subjectively. Three sources of subjectivity occurred with ranking systems:

1. The application of a ranking system to different districts by one individual
2. The application of the same ranking system to different regions within a state by different individuals
3. The use of ranking questions with "soft" non-numerical answers.

While ranking systems were subjective, they had the advantage of being flexible. Formula systems utilized three to five items of quantified data. Ranking systems contained more data in their procedures.

The 1969-1970 school year was the first year that states were required to implement the allocation criteria of the 1968 Vocational Education Amendments. All states surveyed indicated that their first-year systems would undoubtedly be revised in the near future to better meet what most vocational educators felt were valid allocation criteria.

THE PROCEDURES

Definition of Residual Costs

The preceding discussion identified the fact that of the four Federal allocation criteria, state vocational personnel were having the greatest difficulty with excess cost. This seems to be the result of confusion about the basic definition of that criterion.

Consideration of excess cost from the standpoint of fund allocation suggests the concept of "residual" cost. Observation of school districts revealed that they obtained funds for the payment of their vocational education programs from local, state and Federal sources. Operationally, the first sum of money that is available to school districts is that amount of general state aid received for all students, including amounts from the state's foundation program. The latter includes funds from the state, supplemented with required amounts of funds raised from local taxes. This foundation amount is equalized to the degree that the state's foundation program is equalized. Subtracting the general state aid for foundation amount from the total cost of vocational education left a "residual" cost to be paid from Federal or state funds earmarked for vocational education, and from additional local taxes that were levied on an unequalized basis. It is the effect of state allocation practices on that "residual" cost which is being examined by this chapter.

Objectives

To determine the effect of existing state allocation practices on local vocational education residual cost tax rates, accomplishment of the following three objectives was attempted:

1. To identify the tax load borne by local taxpayers for payment of the unequalized local share of the residual cost of the vocational education program.
2. To discover a relationship between the required local residual tax rate and the extent of the vocational education program in the district.
3. To design a model allocation system that would distribute Federal and state vocational education funds from state to local districts on a more equalized basis.

Data Collection

Basic data needed for this analysis were obtained from 21 school districts in seven states by procedures described in Chapter II. In addition to that data, researchers also collected from each district its:

1. Taxable wealth in terms of total assessed valuation
2. Amount of state general aid received
3. Amount of Federal vocational aid received

To identify the amount of vocational education costs contributed by local, state, and Federal governments, the following is an outline of the procedure used:

Total cost of approved vocational education courses in a school district . . . . A

State general aid (including foundation program amounts) applicable to these courses . . . . B

Residual cost of vocational education in the school district (A-B) C

Federal vocational education funds received by the district . . . . D

Local share of the residual cost of vocational education (C-D) . . . . E

EFFECT OF STATE ALLOCATION PRACTICES ON THE LOCAL TAX RATE

Residual Cost Tax Rates

Using standard computational processes, the data collected under the previously described procedure were transposed into the headings found in Tables 6-1, 6-2, 6-3 and 6-4.

Table 6-1 presents the general fiscal data relating to the 21 districts of the seven cooperating states. The size of the districts ranges from 480 to 36,050 ADA. Although differing assessment practices in states would affect the validity of this comparison, it is interesting to note that the assessed valuation per ADA ranges from $13,541 per student up to $206,639 per student, and the total tax rates range from 81 cents to $5.40 per hundred dollars assessed valuation. The cost per student in ADA for general education ranges from $374.90 to $1,228.87.

Column 7 in Table 6-2, headed "Local Tax Rate for Vocational Education Residual Cost," identifies the tax load borne by local taxpayers for the payment of the unequalized local share of the residual cost of their vocational education programs. The greatest range in tax rates occurred in state No. 7. District 7D levied a tax rate of only $.0596 for the local share of the residual cost of its vocational education program; district 7B was required to levy a tax rate of $.2900 or five times as much. The smallest tax rate differences were found in state No. 5. District 5B levied a vocational education residual cost tax rate of $.0440, while district 5D levied $.1159. State No. 5 had a range from low to high residual cost tax rate of $.0719, while state No. 7 had a range of $.2304. The average range between high and low vocational education residual cost tax rates for the seven states was $.1306.

Column 7, Table 6-2 clearly identifies the tax load borne by local taxpayers for the unequalized local share of the residual cost of vocational education programs found in the 21 districts. While differing assessment practices prevented direct comparisons from being made among states, the investigator believes it is safe to conclude that there are inequalities in tax rates required in most states to pay the local share of vocational education programs.

Table 6-3 reveals data that indicate an answer to the question, "Do the districts with the highest local residual tax rates for vocational education receive a higher percent of their vocational education costs from Federal sources?"

Examination shows that only in state No. 4, district 4B, can there be found a district having the highest residual cost tax rate that also received the highest percentage of its vocational program cost paid by the Federal government. This fact indicates that "reward for local fiscal effort" for the support of vocational education is not commonly present in state plans for administering Federal vocational education funds.

TABLE 6-1 Fiscal Data Relating to the Twenty-One Districts

District	Grades 10-12 ADA	Assessed Valuation	Assessed Valuation per ADA	District Total Tax Rate	Non-Voc. Ed. Cost per ADA
(1)	(2)	(3)	(4)	(5)	(6)
1B	$ 5,371	$ 129,745,281	$ 24,156	$ 5.404	$1,228.87
1C	2,097	50,813,629	24,232	3.508	1,084.28
1D	1,189	27,267,973	22,934	4.636	1,011.43
2B	4,012	413,000,000	102,941	.989	684.74
2C	4,251	786,787,950	185,083	1.069	845.79
2D	480	99,187,028	206,639	.81	1,067.15
3B	1,694	171,360,370	101,157	2.483	735.41
3C	11,904	1,071,327,473	89,997	2.95	846.25
3D	1,986	130,348,419	65,633	2.59	742.94
4B	7,422	100,503,481	13,541	4.60	398.64
4C	5,133	201,258,850	39,208	4.407	506.03
4D	2,202	42,906,536	19,485	4.695	581.43
5B	2,839	406,799,220	143,289	1.50	568.04
5C	1,518	158,082,850	104,138	1.50	383.12
5D	3,039	156,245,630	51,413	1.80	765.51
6C	1,044	66,950,120	64,128	2.129	1,189.15
6D	3,941	414,069,692	105,067	3.19	876.24
6E	1,537	86,621,215	56,357	3.12	754.86
7B	9,635	444,123,560	45,375	4.293	673.43
7C	20,442	651,859,450	31,782	1.834	603.31
7D	36,050	1,280,848,910	34,845	4.87	374.93

TABLE 6-2 Computation of the Local Residual Cost Tax Rates in the Twenty-One Districts of the Seven Cooperating States

District	Total Cost of Voc.Ed. Program per ADA	State Foundation Program per ADA	Residual Cost of Voc.Ed. per ADA (2-3)	Federal Share of Res. Cost per ADA	Local Share of Res. Cost per ADA (4-5)	Local Tax Rate for Voc.Ed. Res.Cost*
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1B	$ 1,116.00	$ 521.00	$ 595.00	$ 76.61	$ 518.39	$ .2145
1C	940.51	526.00	414.51	89.25	325.26	.1717
1D	1,101.79	524.00	577.79	86.81	490.98	.3111
2B	1,069.19	456.00	613.19	41.98	571.21	.1029
2C	1,231.20	360.13	871.07	56.88	814.19	.0565
2D	972.00	356.13	615.87	171.80	444.07	.0306
3B	1,305.50	483.10	822.40	22.94	799.46	.0817
3C	1,243.20	428.20	815.00	529.31	286.69	.0450
3D	1,602.04	433.33	1,168.71	44.21	1,124.50	.3076
4B	835.92	450.09	385.83	101.46	284.37	.2679
4C	730.82	471.30	259.52	30.99	228.53	.0514
4D	788.40	487.55	300.85	36.70	264.15	.2533
5B	896.41	208.00	688.41	13.07	675.34	.0440
5C	928.97	115.00	813.97	76.03	737.94	.0881
5D	770.61	323.00	447.61	21.73	425.88	.1159
6C	1,092.00	491.29	600.71	152.23	447.98	.1268
6D	1,026.00	489.89	536.11	164.22	371.89	.0261
6E	1,047.76	496.77	550.99	100.50	450.49	.1078
7B	1,933.26	488.00	1,445.26	164.91	1,280.35	.2900
7C	1,674.60	488.00	1,186.60	172.11	1,014.49	.1276
7D	1,210.64	488.00	722.64	214.78	507.86	.0596

*The tax rate is expressed in cents per $100 of assessed valuation. It is computed by dividing the product of Column 3, Table 6-5 and Column 2, Table 6-2 by Column 3, Table 6-1.

TABLE 6-3 A Comparison of the Local Residual Cost Tax Rate in the Twenty-One Districts to the Percent of the Vocational Education Programs Costs Paid by the State, Federal, and Local Sources

District	Local Tax Rate for Voc. Ed. Residual Cost	% of Voc.Ed. Cost Paid by,		
		State*	Federal	Local
(1)	(2)	(3)	(4)	(5)
1B	$ .2145	46.7%	6.8%	46.5%
1C	.1717	55.9	9.5	34.6
1D	.3111	47.6	7.9	44.5
2B	.1029	42.6	3.9	53.5
2C	.0565	29.3	4.6	66.1
2D	.0306	36.6	17.7	45.7
3B	.0817	37.0	1.8	61.2
3C	.0450	34.4	42.6	23.0
3D	.2076	27.0	2.8	70.2
4B	.2679	53.8	12.1	34.1
4C	.0514	64.5	4.2	31.3
4D	.2533	61.8	4.7	33.5
5B	.0440	23.2	1.5	75.3
5C	.0881	12.4	8.2	79.4
5D	.1159	41.9	2.8	55.3
6C	.1268	28.9	13.9	57.2
6D	.0261	26.0	16.0	58.0
6E	.1078	45.3	9.6	45.1
7B	.2900	26.3	8.5	65.2
7C	.1276	29.1	10.3	60.6
7D	.0596	42.0	17.7	40.3

*Includes state general support applicable to vocational education programs.

TABLE 6-4 An In-Ranking of District Characteristics in the Seven Cooperating States

State (1)	Voc. Ed. R/C Tax (2)	% Voc.Ed. Students (3)	A/V ADA (4)	Cost of Voc.Ed. Program (5)	Voc. Ed. ADA (6)	ADA (7)	Federal Alloc. (8)
1B	2	3	2	1	1	1	3
1C	3	2	1	3	2	2	1
1D	1	1	3	2	3	3	2
2B	1	3	3	2	1	2	3
2C	2	2	2	1	2	1	2
2D	3	1	1	3	3	3	1
3B	2	3	1	2	3	3	3
3C	3	1	2	3	1	1	1
3D	1	2	3	1	2	2	2
4B	1	2	3	1	1	1	1
4C	3	3	1	3	2	2	3
4D	2	1	2	2	3	3	2
5B	3	3	1	2	2	2	3
5C	2	2	2	1	3	3	1
5D	1	1	3	3	1	1	2
6C	1	1	2	1	3	3	2
6D	3	3	1	3	1	1	1
6E	2	2	3	2	2	2	3
7B	1	1	1	1	2	3	3
7C	2	3	3	2	3	2	2
7D	3	2	2	3	1	1	1

Table 6-4 enables comparison of the in-state district rank of the vocational residual cost tax rate to the in-state district rank of other district characteristics. Its purpose is to determine whether a profile of characteristics emerges for districts having a high or low residual cost. Listed below are the results of those comparisons.

1. Residual Cost Tax Rate to Percentage of Vocational Education Students

    a. Of the seven highest residual cost tax rates in each state, four occurred in districts with the largest percentage of vocational education students.

    b. Of the seven lowest residual cost tax rates in each state, three occurred in districts with the lowest percentage of vocational education students.

2. Residual Cost Tax Rate to Assessed Valuation per Student

    a. Of the seven highest residual cost tax rates in each state, five occurred in districts with the lowest assessed valuation per student.

    b. Of the seven lowest residual cost tax rates in each state, five also occurred in districts with the highest assessed valuation.

3. Residual Cost Tax Rate to Cost per Student of Vocational Programs

    a. Of the seven highest residual cost tax rates in each state, four occurred in districts with the highest cost per student of vocational programs.

    b. Of the seven lowest residual cost tax rates in each state, six occurred in districts with the lowest cost per student of vocational programs.

4. Residual Cost Tax Rate to Amount of Federal Funds Received

    a. Of the seven highest residual cost tax rates in each state, only one occurred in a district that also received the highest percentage of Federal funds.

    b. Of the seven lowest residual cost tax rates in each state, five occurred in districts that received the highest percentage of Federal funds.

From the preceding comparisons, the following profile tended to emerge for districts having the highest in-state residual cost tax rate. They had the largest number of vocational students enrolled, the lowest assessed valuation per student, the highest cost per vocational student, and received the lowest percentage of Federal vocational funds. Districts having the lowest in-state residual cost tax rate tended to have the lowest number of vocational students, the highest assessed valuation per student, the lowest vocational cost per student, and received the highest percentage of Federal vocational funds. These profiles suggest the possibility that during the 1969-70 year, state allocation of Federal funds was contrary to the Congressional intent for an equalized distribution of Federal vocational funds.

To obtain more information about tax rates for vocational education, an analysis was made of 12 school districts in California. Information about these districts is presented in Tables 6-5 and 6-6. These districts varied in size from an average daily attendance of 247 to 14,958. The assessed valuation of taxable property per student in grades ten to twelve (inclusive) ranged from $25,726 to $203,083.

The tax rates required to pay the residual cost of vocational education are shown in column 7 of Table 6-6. These tax rates varied from 1.24 cents to 26.74 cents per $100. Except for district No. 2, which has the highest tax rate for vocational education and also the greatest percent of students in vocational education programs, there is little relationship between tax rates for vocational education and percent of students enrolled in vocational programs.

The wide variation in tax rates for vocational education and in percentages of students enrolled in vocational programs indicates a need for greater equalization of vocational education opportunities as well as equalization of local tax rates required to pay for vocational courses.

Residual Tax Rate to Extent of Vocational Education Program

Table 6-7 provides an indication of the effect that the residual cost tax rate has on the extent of the vocational program offered by the local district. To measure the latter, the percentage of contact hours in each vocational program was calculated. These data were derived by dividing the number of annual student contact hours in each vocational program by the total annual student contact hours in a district's total vocational education program.

The column of vocational programs was arranged in Table 6-7 with the lowest cost per contact hour program (Distributive Education) to the left, and with the most expensive program to the right (Health). The cost per annual contact hour for each vocational program is given below each column heading.

TABLE 6-5 General Fiscal and Vocational Education Data for the California Sample Districts

Calif. Districts	Total District Assessed Valuation	Grades 10-12 Total ADA	Assessed Valuation Per Gr. 10-12 ADA (2÷3)	Total Voc. Ed. ADA	Percent Students in Voc.Ed. (5÷3)	Percent of Voc. Ed. Cost Paid by: State	Fed.	Local
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	$	$	$	$	%	%	%	%
1	50,161,710	247	203,083	23.67	9.58	30.15	0	69.85
2	19,240,312	334	57,606	74.00	22.16	39.01	10.32	50.67
3	27,200,617	420	64,763	28.40	6.76	68.34	4.76	26.90
4	48,694,863	701	69,465	32.40	4.62	32.66	9.29	58.05
5	30,745,567	903	34,048	85.09	9.42	72.65	6.32	21.03
6	55,678,612	1,571	35,442	74.02	4.71	27.08	16.59	56.33
7	53,073,694	2,063	25,726	174.30	8.45	52.15	12.11	35.74
8	93,763,980	3,053	30,712	273.00	8.94	38.18	14.83	46.99
9	149,768,160	4,262	35,140	142.00	3.33	31.82	15.56	52.62
10	342,776,559	6,038	56,769	144.90	2.40	28.12	12.32	59.56
11	363,154,128	10,033	36,196	294.86	2.94	28.14	16.21	55.65
12	576,621,494	14,958	38,549	592.00	3.96	49.35	11.11	39.54
TOTALS	$1,810,879,696	44,583	40,618	1,938.64	4.35	38.33	13.17	48.50

TABLE 6-6 The 1970-71 California Allocation System Applied to the Sample Districts with the Resulting Local Residual Cost Tax Rate

Calif. Districts	Total Cost of Voc. Ed. Program	State Foundation Program Support	Total Res. Cost of Voc. Ed. Program (2-3)	Federal Share of Voc.Ed.Res. Cost	Local Share of Voc.Ed.Res. Cost (4-5)	Local Voc.Ed.Res. Cost Tax Rate*
(1)	(2)	(3)	(4)	(5)	(6)	(7)
	$	$	$	$	$	$
1	38,314	11,551	26,763	10,000	16,763	.0334
2	92,565	36,112	56,453	5,000	51,453	.2674
3	20,279	13,859	6,420	3,048	3,372	.0124
4	48,405	15,811	32,594	4,500	28,094	.0577
5	57,155	41,524	15,631	9,000	6,631	.0215
6	133,400	36,121	92,279	10,205	87,074	.1564
7	163,099	85,058	78,041	15,926	62,115	.1170
8	348,901	133,224	215,677	22,996	192,681	.2054
9	217,778	69,296	148,482	28,670	119,812	.0799
10	251,505	70,711	180,794	44,415	136,379	.0397
11	511,287	143,891	367,396	74,527	292,869	.0806
12	585,324	288,896	296,428	97,200	199,228	.0345
TOTALS	$2,468,012	946,054	1,521,958	325,487	1,196,471	.066

*This tax rate is expressed in cents per $100 of assessed valuation. It is computed by dividing Col. 6 by the district's assessed valuation (Col. 2 in Table 6-5).

TABLE 6-7 A Comparison of the District Rankings of Assessed Valuation per ADA and Vocational Education Program Residual Cost Tax Rate to the Percent of Contact Hours in the Vocational Programs Arranged by Cost per Annual Student Contact Hour

District	District Rank by A/V per ADA	District Rank by Residual Cost Tax Rate	Percent of Contact Hours in Vocational Programs Arranged by Cost per Annual Student Contact Hour						
			D.E. ($ .92)	Office ($1.01)	Home Ec. ($1.18)	T.& I. ($1.67)	Ag. ($1.69)	Tech. ($2.18)	Health ($2.26)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1B	2	2	5.59%	48.41%	44.96%	1.04%	-0- %	-0- %	-0- %
1C	1	3	9.76	61.04	16.53	7.32	5.35	-0-	-0-
1D	3	1	11.64	32.41	35.73	10.29	7.81	-0-	2.12
2B	3	1	7.64	21.22	15.96	37.54	17.64	-0-	-0-
2C	2	2	20.42	24.08	20.27	26.12	1.89	4.11	3.11
2D	1	3	21.90	36.25	2.92	19.71	19.22	-0-	-0-
3B	1	2	17.64	20.64	-0-	61.72	-0-	-0-	-0-
3C	2	3	9.52	17.62	23.11	48.58	1.17	-0-	-0-
3D	3	1	13.57	29.64	13.23	43.56	-0-	-0-	-0-
4B	3	1	1.72	41.85	29.18	19.95	7.30	-0-	-0-
4C	1	3	5.05	35.37	40.46	12.40	6.72	-0-	-0-
4D	2	2	7.70	19.04	28.06	11.26	28.43	-0-	5.51
5B	1	3	6.48	40.71	4.50	44.41	3.90	-0-	-0-
5C	2	2	12.70	11.32	17.58	49.48	8.92	-0-	-0-
5D	3	1	4.10	41.22	12.49	35.85	4.25	-0-	2.09
6C	2	1	20.49	13.10	19.44	40.81	-0-	-0-	6.16
6D	1	3	9.62	36.36	29.14	24.88	-0-	-0-	-0-
6E	3	2	23.71	22.43	18.73	32.72	2.41	-0-	-0-
7B	1	1	9.61	50.17	22.54	7.23	7.28	2.38	.79
7C	3	2	4.39	43.80	38.33	1.02	12.46	-0-	-0-
7D	2	3	6.42	44.93	36.08	9.59	.58	-0-	2.42

The district ranking within its state by residual cost tax rate is listed in Column 3. The investigator also included the assessed valuation per ADA (in Column 2) to amplify the relationship between the vocational programs and the residual cost tax rate.

When the district with the largest percent of contact hours in the two lowest cost vocational programs was identified in each of the seven states, two of these districts (3D and 4B) had the highest residual cost tax rate ranking in their respective state. These same districts were also the lowest ranked districts in their states according to wealth. Or, describing this analysis in another manner, these data indicated that in two states the poorest, highest tax-paying districts had the largest percentage (43.21% and 43.57%) of their vocational offerings in the two lowest cost vocational programs. It is important to note also that neither of these two districts had the two most expensive programs (Health and Technical Education) in their total vocational offerings.

What were the characteristics of the districts that had the largest percent of the more costly vocational programs? In an attempt to answer this question, the district in each state with the largest percent of contact hours in Agriculture, Trade and Industry, Health, and Technical Education was identified. These districts were 1D, 2B, 3B, 4D, 5C, 6C and 7C; three of them had the highest residual cost tax rate rank in their respective state. The remaining four districts were ranked number two in residual cost tax rates. Thus the first characteristic of all the districts having the costliest programs in their vocational offerings was a high residual cost tax rate. Secondly, four of these seven districts were ranked number one or two in the wealth rating in their state. Rephrasing this finding in a more general manner, the districts with the largest percentage of their contact hours in the four most costly vocational programs were the wealthier districts, which taxed themselves at a high rate to provide a full program of vocational education for their students. District 7B illustrated this general finding; of the three districts studied in state No. 7, it ranked first in wealth and residual cost tax rate, and was the only district of the three that provided course offerings to its students in all seven of the vocational programs.

DISTRIBUTION OF FEDERAL VOCATIONAL FUNDS AMONG SCHOOL DISTRICTS

In order to provide more opportunities for vocational education and more nearly equal tax rates, it is suggested that the state, utilizing Federal vocational education funds, should reimburse school districts for a percentage of the residual cost of vocational education programs, and that the reimbursement percentage should be inversely related to the taxable wealth of the school district. The formulas suggested for computing the reimbursement percentages are:

$$\text{(I)} \quad P = \frac{3 - Q}{3 + Q} \qquad \text{or} \qquad \text{(II)} \quad P = \frac{3 - Q}{4}$$

where Q is the quotient obtained by dividing the assessed value of taxable property per pupil in the school district by the corresponding assessed value per pupil for the state as a whole.

For a school district of average wealth (Q equals 1), both of these formulas produce 50 percent reimbursement rates. Moreover, both formulas produce zero reimbursement rates for school districts in which the taxable wealth per student is three times the state average ($Q = 3$).

If available funds for vocational education are insufficient to finance an average reimbursement rate of 50 percent, the formulas would need to be altered. For example, if funds are available for only an average 25 percent reimbursement rate, the formula becomes:

$$(I') \quad P = \frac{5/3 - Q}{5/3 + Q}$$

or

$$(II') \quad P = \frac{2 - Q}{4}$$

Formulas I' and II' both produce 25 percent reimbursement rates for school districts of average taxable wealth per pupil. However, they differ in "cutoff points," i.e., the value of Q which produces a value of zero for P. Under Formula I', a school district in which the taxable wealth per pupil equals 1-2/3 times the state average (Q equals 5/3) would receive no Federal vocational funds. Under Formula II', the cutoff point would be Q equals 2.

This reduction of the cutoff point reflects the fact that, with fewer funds available, it is necessary to concentrate on the fiscal needs of low-wealth school districts and provide less state aid for school districts in which the taxable wealth per pupil is substantially above the state average.

Formulas I' and II' indicate the flexibility of the variable percentage grant approach. The percentage formulas can be adjusted to meet budgetary constraints and different emphases upon equalization of school tax rates. (For the derivation of these formulas see Chapter I and a paper by Lindman entitled "Equalization of School Support Among States by Federal Matching," Journal of Educational Research, Vol. 38, No. 8, April, 1945.)

RECOMMENDATION

State educational administrators should consider the following five-step procedure for allocating Federal and earmarked state vocational funds among school districts. This procedure meets the requirements of the 1968 Amendments to the Federal Vocational Education Act.

1. First, the state education agency should review and approve all vocational education programs proposed by high schools and junior colleges which have been planned to meet manpower needs and the vocational education demands of the community.

2. Second, after the proposed programs have been approved, the state education agency should establish a cost control estimate for approved vocational education programs in each school district by using the "three-component" plan described in Chapter II.

3. Third, from the total estimated cost of vocational education in each school district, there should be deducted the estimated amount of general state aid (including foundation program allotments) earned by the approved vocational education programs. This difference is the estimated residual cost of approved vocational education programs and may be used as a basis for partial advance payments.

4. Fourth, at the close of the year the actual amount expended for vocational education programs and the actual amount of general state aid earned by these programs should be determined. The difference between these two figures is the residual cost of the approved vocational education programs and should be the basis for the final payment to local school districts from Federal and state funds earmarked for the support of vocational education programs.

5. Fifth, since there may not be sufficient Federal and state funds to reimburse the residual cost in full, an equalized percentage grant should be made by calculating for each district a reimbursement percentage using a formula similar in format to those suggested in this chapter. The reimbursement percentage should then be multiplied by the district's residual cost to obtain the amount of the district's vocational education payment.

REFERENCES

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8. Erick L. Lindman, *Financing Vocational Education in the Public Schools* (National Educational Finance Project, Special Study No. 4), pp. 67-81.

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APPENDICES

APPENDIX CHAPTER II-A

PARTICIPATING STATES AND SCHOOL DISTRICTS

PARTICIPATING SCHOOL DISTRICTS

California	Foothill Junior College District
	San Jose Unified School District
	Kern Joint Union School District
	San Diego Unified School District
Florida	South Florida Junior College
	Manatee County School Board
	Sarasota County School Board
	Hardee County School Board
Michigan	Kellogg Community College
	Coldwater Community Schools
	Kalamazoo Public Schools
	Niles Community Schools
	Benton Harbor Public Schools
Ohio	Four County Vocational Institute
	Bedford City Schools
	Toledo City Schools
	Findlay City Schools
	Four County Vocational High School
Texas	Central Texas College
	Goose Creek School District
	Lamar School District
	Northeast Houston School District
Utah	Dixie Junior College
	Davis School District
	Jordan School District
	Nebo School District
Washington	Shoreline Community College
	Edmonds School District
	Puyallup School District
	South Kitsap School District

APPENDIX CHAPTER II-B

DATA COLLECTION INSTRUMENTS

FINANCING VOCATIONAL EDUCATION
DISTRICT LEVEL INFORMATION

DATA COLLECTION FORM I

State:_________________________Name of District:______________________________

Prepared by:_____________________________________Date:__________________

Note: This form applies to either secondary or post-secondary district data. Please check appropriate box: SECONDARY (10-12) [ ]

POST-SECONDARY (13-14) [ ]

Classified District Budget Expenditures

I.	Instructional Programs	________
II.	Instructional Support	________
III.	Pupil Services	________
IV.	General Support	________
V.	Plant Operation and Maintenance	________
VI.	Community Services	________

Miscellaneous District Information

I.	District's average annual teacher's salary.	________
II.	The number of contact hours of a full-time student in other programs in the district.	________
III.	The number of contact hours of a full-time vocational student in the district.	________
IV.	The unit of measure which constitutes a full-time teacher in the district.	________
V.	The number of weeks for which classes were in session.	________
VI.	District total annual aggregate contact hours.	________
VII.	Annual aggregate contact hours for all other programs in the district.	________
	a. Total Vocational contact hours =	________
	b. Total Industrial Arts " " =	________

FINANCING VOCATIONAL EDUCATION

VOCATIONAL TEACHER INFORMATION

DATA COLLECTION FORM II

Year ☐
Semester ☐
Quarter ☐

State: ______________________ School District: ______________________ Instructional Period:

Instructor's Name	Total Annual Salary	Ag.		D.E.		Off.		Hlth.		H.E.		Tech.		T & I		Total V.E.		I.A.		O.I.P.	
		I/C*	A/S**	I/C*	A/S**	I/C*	A/S**	I/C*	A/S**	I/C*	A/S**	I/C*	A/S**	I/C*	A/S**	I/C*	A/S**	I/C*	A/S**	I/C*	A/S**

* I/C = % Instructional Contact

**A/S = Actual Salary

FINANCING VOCATIONAL EDUCATION

VOCATIONAL PROGRAM INFORMATION

DATA COLLECTION FORM III

State:____________________School District:____________________School:____________________

I. V.E. Occupational Direct Cost	Ag.	D.E.	Off.	Hlth.	H.E.	Tech.	T & I	Total V.E.	I.A.	O.I.P.
1. Voc. Dir. Sal.										
2. Voc. Super. Sal.										
3. Voc. Tchrs.'Sal.										
4. Voc. Sec. Sal.										
5. Other Sal.										
6. Textbooks										
7. Supplies										
8. Rep. Equip.										
9. Other Expenses:										
a.										
b.										
c.										
II. No. of Student Contact Hours										
III. No. FTE Teachers										
IV. Avg. Class Size										
V. Instruc. Sq.Ft.										

APPENDIX CHAPTER II-C

VOCATIONAL WORKSHEETS

WORKSHEET I

VOCATIONAL PROGRAM COST WORKSHEET

School District:____________________________ State:________________________________

High School:_____________ Community College:___________________________ Year:_________

	Instructional Programs & Services									
Data Identification	Ag.	D.E.	Off.	Hlth.	H.E.	Tech.	T&I	I.A.	Total V.E.	O.I.P.
I. Direct Cost										
II. Instruct. Support										
A. Stu. Contact Hours										
B. Instruct. Sup. %										
C. Instruct. Sup. Cost										
III. General Support										
A. FTE Teachers										
B. Gen. Sup. %										
C. Gen. Sup. Cost										
IV. Oper. & Maintenance										
A. Square Footage										
B. Oper. & Maint. %										
C. Oper. & Maint. Cost										
V. Indirect Cost (II+III+IV)										
VI. Total Cost (I+V)										
VII. Cost/Stu.Cont.Hr.(V/IIA)										
VIII. Cost Ratios										
IX. % Indirect/Direct Cost										

WORKSHEET II

K FACTOR WORKSHEET

School District______________________________State__________

High School____________________J.C.________________Year______

1. District average cost per student ($\overline{C}$) ________________________

2. District average student-faculty ratio ($\overline{N}$)______________________

VOCATIONAL PROGRAMS	Vc	N	$\frac{\overline{N}}{N}$	K
Agriculture				
Distributive				
Office				
Health				
Home Economics				
Technical				
Trade & Industry				
Industrial Arts				

$$K = \frac{Vc}{\overline{C}} - \frac{\overline{N}}{N}$$

APPENDIX CHAPTER II-D

HIGH SCHOOL DISTRICT COST DATA AND COST RATIOS

AVERAGE COST PER STUDENT CONTACT HOUR FOR INDICATED INSTRUCTIONAL SERVICES & PROGRAMS, BY HIGH SCHOOL DISTRICT, FOR 1969-70

Dist.	(1) O.I.P.	(2) I.A.	(3) T.O.C.	(4) Ag.	(5) D.E.	(6) Off.	(7) Hlth.	(8) H.E.	(9) Tech.	(10) T & I
1B	1.06	2.10	1.24		1.82	1.10		1.32		1.60
1C	.94	1.28	.95	1.49	.90	.81		1.39		.58
1D	.64	.60	1.02	1.33	.81	.92	1.15	.85		1.90
2B	.68	1.41	.99	1.14	1.40	.75		.97		.97
2C	.71	1.33	1.14	1.89	.89	.65	5.86	.79	1.41	1.38
2D	.77		.90	1.29	.80	.68		1.40		.95
3B	.94	1.14	1.29		.79	2.75				.44
3C	.73	.99	1.12	2.07	.55	1.93		.83		1.05
3D	.68	1.10	1.50		1.17	1.26		1.36		1.82
3E	1.02		1.29	1.76	1.51	1.19	1.50	1.28		1.76
4B	.47	.53	.86	1.45	.53	.78		.68		1.11
4C	.56	.55	.58	.66	.77	.69		.34		.45
4D	.43	.67	.73	.78	.63	.75	.31	.39		1.20
5B	.49	.65	.83	2.93	1.68	.33		3.41		.73
5C	.48	.65	.86	1.75	.50	.90		.94		.75
5D	1.03	.75	.72	1.33	1.32	.38	1.18	.99		.84
6C	1.23	1.18	1.00		.58	.66	1.04	.81		1.40
6D	.89	1.28	1.14		1.12	1.06		1.25		1.13
6E	.68	1.05	.97	1.89	.64	.99		.93		1.11
6F	.68	.86	1.03	1.75	.88	.97		.82		1.43
7B	.77	1.68	1.80	2.22	.86	.83	5.55	2.03	2.91	2.79
7C	.77	1.53	1.73	1.78	.28	1.68		1.84		5.39
7D	.45	.87	1.14	2.84	.65	1.06	1.50	1.05		1.09

COST RATIOS FOR INDICATED INSTRUCTIONAL SERVICES AND PROGRAMS, BY HIGH SCHOOL DISTRICT, FOR 1969-70

Dist.	(1) O.I.P.	(2) I.A.	(3) T.O.C.	(4) Ag.	(5) D.E.	(6) Off.	(7) Hlth.	(8) H.E.	(9) Tech.	(10) T & I
1B	1.00	2.10	1.24		1.82	1.10		1.32		1.09
1C	1.00	1.36	1.01	1.59	.96	.86		1.48		.94
1D	1.00	.91	1.59	2.09	1.27	1.44	1.80	1.33		2.97
2B	1.00	2.07	1.46	1.68	2.06	1.10		1.43		1.43
2C	1.00	1.87	1.61	2.66	1.25	.92	8.25	1.11	1.99	3.94
2D	1.00		1.17	1.68	1.04	.88		1.94		1.23
3B	1.00	1.21	1.37		.84	2.93				1.00
3C	1.00	1.23	1.53	2.84	.75	2.64		1.14		1.44
3D	1.00	1.62	2.21		1.72	1.85		2.01		2.68
3E	1.00		1.26	1.73	1.48	1.17	1.47	1.25		1.24
4B	1.00	1.13	1.83	3.09	1.13	1.66		1.45		2.36
4C	1.00	.98	1.04	1.18	1.38	1.23		.61		1.70
4D	1.00	1.56	1.70	1.81	1.47	1.77	.72	1.37		2.79
5B	1.00	1.33	1.69	5.98	3.43	.67		6.96		1.49
5C	1.00	1.35	1.79	3.65	1.04	1.88		1.96		1.56
5D	1.00	.73	.70	1.29	1.28	.37	1.15	.96		.82
6C	1.00	.96	.81		.47	.54	.85	.66		1.11
6D	1.00	1.44	1.28		1.26	1.19		1.10		1.27
6E	1.00	1.54	1.43	2.78	.94	1.46		1.37		1.68
6F	1.00	1.26	1.51	2.57	1.29	1.43		1.21		2.18
7B	1.00	2.18	2.34	2.88	1.12	1.09	7.21	2.64	3.82	10.12
7C	1.00	1.99	2.25	2.31	.36	2.18		2.39		6.38
7D	1.00	1.93	2.53	6.31	1.44	2.36	3.33	2.33		4.12

APPENDIX CHAPTER II-E

COMMUNITY COLLEGE DISTRICT COST DATA AND COST RATIOS

AVERAGE COST PER STUDENT CONTACT HOUR FOR INDICATED INSTRUCTIONAL SERVICES & PROGRAMS, BY COMMUNITY COLLEGE DISTRICT, FOR 1969-70

Dist.	(1) O.I.P.	(2) I.A.	(3) T.O.C.	(4) Ag.	(5) D.E.	(6) Off.	(7) Hlth.	(8) H.E.	(9) Tech.	(10) T & I
1A	1.69		2.02		1.81	1.83	2.57	1.98	1.77	2.53
2A	1.71		2.07	2.91		1.83	1.80	2.20	1.73	1.75
3A	1.61		2.58	1.96	3.29	1.94		2.24		3.26
4A	1.27		2.28			1.91		1.96	1.52	4.24
5A	.89		2.09	1.80	1.55	2.24	1.95		2.58	1.94
6A	2.03		2.24			2.63	1.87		2.36	
7A	1.26		2.20		1.48	1.76	3.83	2.29	2.21	2.14

TABLE E-21

COST RATIOS FOR INDICATED INSTRUCTIONAL SERVICES & PROGRAMS, BY COMMUNITY COLLEGE DISTRICT, FOR 1969-70

Dist.	(1) O.I.P.	(2) I.A.	(3) T.O.C.	(4) Ag.	(5) D.E.	(6) Off.	(7) Hlth.	(8) H.E.	(9) Tech.	(10) T & I
1A	1.00		1.20		1.07	1.08	1.52	1.17	1.05	1.59
2A	1.00		1.21	1.70		1.07	1.05	1.29	.79	1.16
3A	1.00		1.60	1.22	2.04	1.21		1.39		2.02
4A	1.00		1.80			1.50		1.54	1.20	3.34
5A	1.00		2.35	2.02	1.74	2.52	2.19		2.90	2.18
6A	1.00		1.10			1.30	.92		1.16	
7A	1.00		1.75		1.17	1.40	3.04	1.82	1.75	1.70

APPENDIX CHAPTER III

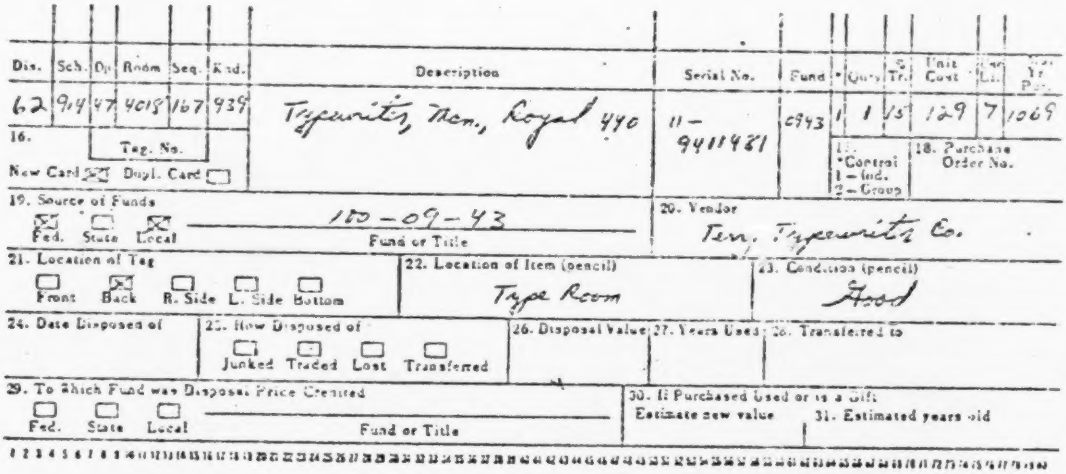
EQUIPMENT INVENTORY CARD

APPENDIX III

EQUIPMENT INVENTORY CARD

The card illustrated below represents a revision of one developed by the Utah State Board of Education. Its purpose is threefold:

1. To gather inventory data
2. To serve as a data deck for computer analysis
3. To become part of a manual filing system



Dis.	Sch.	Op.	Room	Seq.	Kind.	Description	Serial No.	Fund	*	Qty.	Tr.	Unit Cost	Li.	Yr. Pur.
62	9.4	47	4018	167	939	Typewriter, Man., Royal 440	11- 9411481	0943	1	1	15	129	7	1069

16. Tag. No.

New Card ☒ Dupl. Card ☐

17. *Control 1 – Ind. 2 – Group

18. Purchase Order No.

19. Source of Funds ☒ Fed. ☐ State ☒ Local 100-09-43 Fund or Title

20. Vendor Ten. Typewriter Co.

21. Location of Tag ☐ Front ☒ Back ☐ R. Side ☐ L. Side ☐ Bottom

22. Location of Item (pencil) Type Room

23. Condition (pencil) Good

24. Date Disposed of

25. How Disposed of ☐ Junked ☐ Traded ☐ Lost ☐ Transferred

26. Disposal Value

27. Years Used

28. Transferred to

29. To Which Fund was Disposal Price Credited ☐ Fed. ☐ State ☐ Local Fund or Title

30. If Purchased Used or is a Gift: Estimate new value

31. Estimated years old

The information is filled in as shown at the time of the physical inventory, or when equipment is purchased. It can later be keypunched and filed.

Spaces 1 through 15 are not numbered, but go from left to right along the top of the card; each space has three vertical sections: the top section is for the keypunched print-out; the center space is for the printed titles; the bottom space is for handwritten or typewritten inventory information.

A brief explanation of each space beginning at the far top left follows:

"Dis.," district, and "Sch.," school, are designations assigned to identify administrative units. Each digit of the number could be used to further subdivide the districts and schools by size, location, function, or age level. These classifications could be useful in requesting information from the computer data bank.

The designations consisting of "Dp.," department, "Room," and Seq.," sequence, make up the tag number for the item of equipment. The school number may be added to the tag number if so desired. The department consists of such areas as Agriculture, Distributive or Office. Room number indicates the room in which the equipment is used. Sequence represents a sequential numbering of each item as it is purchased for the department, i.e., it is to begin at 001 with each department.

Sometimes it is useful to identify the kind of equipment for classification purposes. The classification is usually quite broad, showing different numbers for typewriters, calculators, duplicators, etc.

A description of the item of equipment is essential and should be uniform in sequence. The first word should identify the kind of equipment, such as "typewriter" or "calculator." Then a further description, such as "manual" or "printing", is given. The next description should be the brand name, such as: "Smith-Corona," or "Monroe." After that any additional information is supplied, such as: size, style, model or color. The card allows for 31 keypunch spaces. Common abbreviations are suggested so that the maximum amount of information can be keypunched.

A district tag number, if different from that specified on the card, may be substituted for the serial number. The last ten digits of the serial number are used. Often a model or size designation is included in the serial number. These numbers may be put in the description space or serial number space, depending upon the space allocation. A number representing the fund used to purchase the equipment may be valuable.

Occasionally equipment may be delivered in group lots without a serial number, and have the same price, purchase date, PUL, and trade-in value, such as with desks and chairs. One card can be used to cover all similar items. In this event, the number "2" is placed in the space identified by an asterisk (*). If it is an individual item or a set, use the number "1" (see item 17 on the card).

Closely related to the previous item is "Quty," quantity. The number of items of equipment represented on the card is listed in this space. If it is a set, list only the number of sets.

The "% Tr.," percent trade, is the approximate trade-in value of the equipment at the end of its predicted useful life and is expressed as a percentage of the original cost. Equipment costing $200 that is predicted to have a $20 trade-in value, has a "% Tr." of 10.

Unit cost is the cost to the district or school of each item of equipment, less trade-in, discounts, and other deductions from the vendor's price. If the card lists the items as groups, the individual cost is still listed. If the item comes as a set, list the set price.

The "Use Li.," predicted useful life, is expressed in number of years the equipment is expected to be used before it is discarded or replaced.

"Mo. Yr. Pur." is the month and year in which the item of equipment was purchased.

This summarizes the first 15 items of the card. The next sections, numbers 16 through 31, are explained as follows:

16. Occasionally something will happen to equipment that causes the keypunched information to change. In that event, a duplicate card may have to be made; however, the original card should be kept for further reference.

17. This is a key to the item (*) on the top line and has been explained.

18. The purchase order number or other original purchase document is identified here.

19. The full identification of the source of funds used to purchase the equipment.

20. The name of the firm from which the equipment was purchased.

21. Description of tag location for easy identification.

22. Although room number appears on the top line, further explanation of the location may be necessary.

23. A brief explanation of the present condition of the equipment.

Items 24 through 29 are filled in when the equipment is no longer used. This information is valuable when revising PUL lists, determining equipment acquisition lists, and giving proper credit to funds used in the original purchase of the equipment.

Items 30 and 31 deal with used and gift equipment which has value in instructional situations. In order to project future costs, the information in these two blocks is necessary inasmuch as it cannot be predicted if it will be replaced with used or gift equipment.

The back of this card can be used to keep maintenance data. If the card is also used as a data deck, it should be handled carefully and kept filed at all times.